SAE INTERNATIONAL

SURFACE VEHICLE STANDARD

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(R) Communication Between Plug-in Vehicles and Off-Board DC Chargers

RATIONALE

SAE J2847-2 provides messages for DC energy transfer. This is based on the use cases in SAE J2836/2 that established the DC charging requirements. This revision adds Section 6, which includes the digital communication messages and signals for off-board inverters that are described in SAE J2836/3 for DC vehicle-to-grid (V2G) and vehicle-to-home (V2H). The system for V2G/V2H is also included such as pre-charging the DC EVSE and the home system requirements for isolation for V2H.

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https://www.sae.org/standards/content/J2847/2_202309/

1. SCOPE

This SAE Recommended Practice establishes requirements and specifications for communication between plug-in electric vehicle (PEV) and the DC off-board charger. Where relevant, this document notes, but does not formally specify, interactions between the vehicle and vehicle operator.

This document applies to the off-board DC charger for conductive charging, which supplies DC current to the rechargable energy storage system (RESS) of the electric vehicle through a SAE J1772 coupler. Communications will be on the SAE J1772 pilot line for PLC communication. The details of powerline communications (PLC) are found in SAE J2931/4.

This document supports DC energy transfer via forward power flow (FPF) from source to vehicle.

SAE has published multiple documents relating to PEV and vehicle-to-grid interfaces. The various document series are listed below, with a brief explanation of each.

SAE J2836 General Requirements and Use Cases. This document is divided into several sections. SAE J2836/1 is for utility/smart grid messaging. SAE J2836/2 is for DC charge control. SAE J2836/3 is for reverse energy flow. SAE J2836/4 is for diagnostics. SAE J2836/5 is for consumer requirements and the HAN. SAE J2836/6 is for wireless charging.

SAE J2847 Functional Messaging Requirements. This document defines the functional messages required for a given function. This document is divided into several sections that correspond to SAE J2836 above. SAE J2847/1 is for utility/smart grid messaging. SAE J2847/2 is for DC charge control. SAE J2847/3 is for reverse energy flow. SAE J2847/4 is for diagnostics. SAE J2847/5 is for consumer requirements. SAE J2847/6 is for wireless charging.

SAE J2931 Digital Communications for PEVs. This series of documents defines the requirements to enable digital communications for PEVs. It is divided into several sections. SAE J2931/1 describes overall requirements. SAE J2931/4 is wired communications using PLC. SAE J2931/5 is telematics. SAE J2931/6 is for wireless charging. SAE J2931/7 includes the security for each of these.

SAE J2953 Plug-In Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE). This is the series that include the requirements in SAE J2953/1 and test procedures in SAE J2953/2, for all the previous documents, including SAE J1772's control pilot and proximity circuits and functions.

SAE J3072 Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems. This document includes the requirements for onboard inverters to send/receive the grid signals for vehicle-to-grid (V2G) functions.

Figure 1 shows the sequencing of these documents and their primary function (e.g., the SAE J2836 and SAE J2847/1 documents start with smart charging, SAE J2836 and SAE J2847/2 then adds DC charging, etc.). The intent is to have subsequent slash sheets complement each other as more functions and features are included. The /6 series of documents add wireless charging items not already included in the proceeding slash sheets. These are all then included in interoperability in SAE J2953 and security in SAE J2931/7. SAE J3072 then includes the PEV to grid requirements for vehicle-to-grid (V2G) power and communication to match SAE J2836/3 use cases.

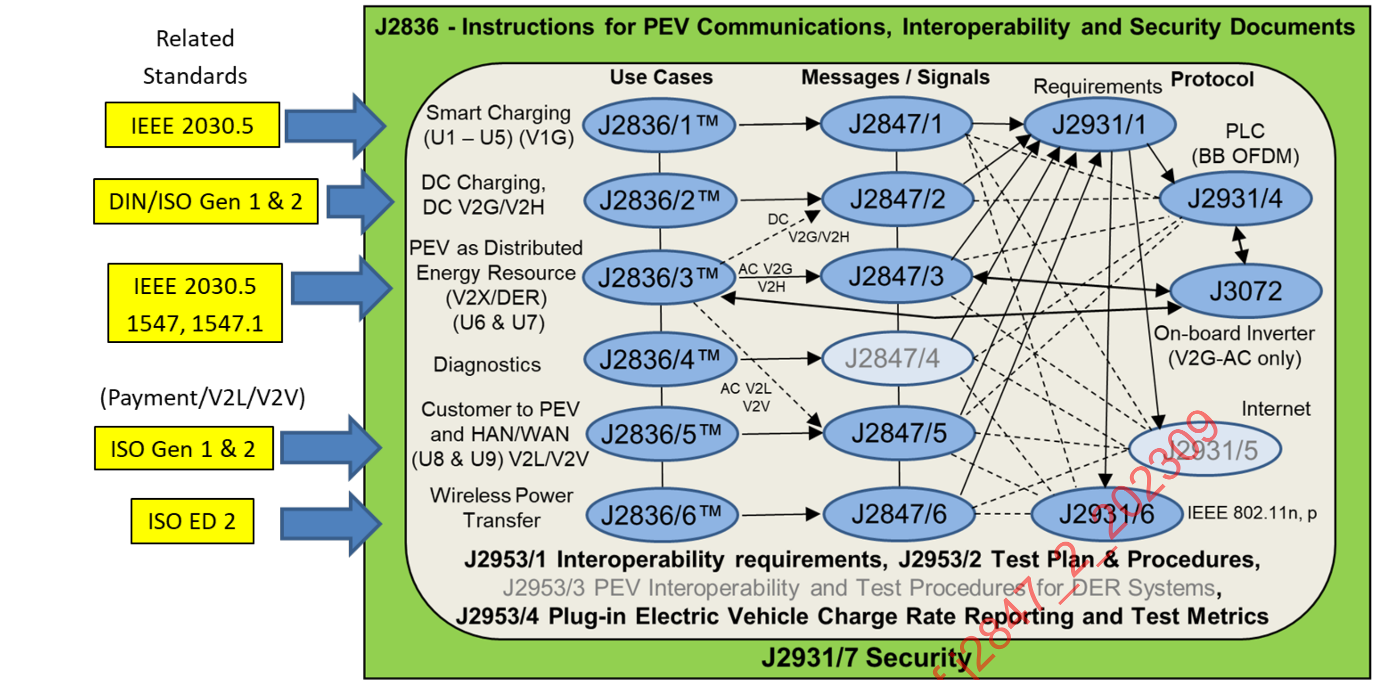


Figure 1 - Document interaction

The summary of documents for DC charging is then as follows:

- SAE J1772 is the PEV to EVSE systems document and includes the system and timing diagrams for DC charging.
- SAE J2836/2 starts with the use cases for DC charging communications.
- SAE J2847/2 then transforms these use case requirements into the signals and messages.
- SAE J2931/1 is where the protocol requirements are placed for all PEV communications.
- SAE J2931/4 is used for the PLC communication requirements for DC charging since it is only a wired median.
- SAE J2953/1 is the interoperability requirements.
- SAE J2953/2 is the interoperability procedure and plan.
- SAE J2931/7 includes the security.

1.1 Purpose

The primary purpose of SAE J2847/2 is to provide the communication to achieve RESS charging control irrespective of RESS variations or energy storage technology.

SAE J2847/1 identifies the functional messaging for the PEV to connect to the utility or service provider and participate in available programs. This document, SAE J2847/2, identifies the additional messages for DC energy transfer to the PEV.

The specification supports DC energy transfer via forward power flow (FPF) from grid to vehicle, and DC reverse power flow (RPF) from vehicle to grid is included in SAE J2847/3. DC forward power flow is used to charge the vehicle's rechargeable energy storage system (RESS).

NOTE: In this specification, we use the terms "FPF" and "RPF" as precisely defined, and avoid the term "V2G" because its meaning has become ambiguous through divergent common usages.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1772 SAE Electric Vehicle and Plug-in Hybrid Electric Vehicle Conductive Charge Coupler

SAE J2836/1 Use Cases for Communication Between Plug-in Vehicles and the Utility Grid

SAE J2836/2 Use Cases for Communication Between Plug-in Vehicles and Off-Board DC Charger

SAE J2836/3 Use Cases for Plug-in Vehicle Communication as a Distributed Energy Resource

SAE J2847/1 Communication for Smart Charging of Plug-in Electric Vehicles Using Smart Energy Profile 2.0

SAE J2931/1 Digital Communications for Plug-in Electric Vehicles

SAE J2931/4 Broadband PLC Communication for Plug-in Electric Vehicles

SAE J2931/7 Security for Plug-in Electric Vehicle Communications

SAE J2953/1 Plug-in Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE)

SAE J2953/2 Test Procedures for the Plug-in Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE)

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1715 Hybrid Electric Vehicle (HEV) and Electric Vehicle (EV) Terminology

SAE J1939 Serial Control and Communications Heavy-Duty Vehicle Network - Top-Level Document

SAE J2894/1 Power Quality Requirements for Plug-in Electric Vehicle Chargers

2.2.2 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

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

IEC 61851-23 Electric vehicle conductive charging system - Part 23: D.C. electric vehicle charging station

IEC 61851-24 Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging

IEC 62196-3 Plugs, socket-outlets, and vehicle couplers - Conductive charging of electric vehicles - Part 3: Dimensional interchangeability requirements for d.c. pin and contact-tube vehicle couplers

2.2.3 ISO Publications

Copies of these documents are available online at https://webstore.ansi.org/.

ISO 15118-1 Road vehicles - Vehicle-to-grid communication interface - Part 1: General information and use-case definition

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

ISO 15118-4 Road vehicles - Vehicle-to-Grid Communication Interface - Part 2: Network and application protocol requirements

ISO 15118-5 Road vehicles - Vehicle-to-grid communication interface - Part 5: Physical and data link layer conformance tests

ISO 15118-20 Road vehicles - Vehicle-to-grid communication interface - Part 20: Network and application protocol requirements

2.2.4 IEEE Publications

Available from IEEE Operations Center, 445 and 501 Hoes Lane, Piscataway, NJ 08854-4141, Tel: 732-981-0060, www.ieee.org.

IEEE 1815 Standard for Electric Power Systems Communications-Distributed Network Protocol (DNP3)

IEEE 1547-2003 Standard for Interconnecting Distributed Resources with Electric Power Systems

IEEE 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

IEEE 1547.1-2005 Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems

IEEE 1547.1-2020 Standard Conformance Test Procedures for Equipment Interconnecting Distributed Energy Resources with Electric Power Systems and Associated Interfaces

IEEE 2030.5-2018 Standard for Smart Energy Profile Application Protocol (SEP2)

2.2.5 UL Publications

Available from UL, 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-272-8800, www.ul.com.

UL 1741	Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
UL 9741	Outline of Investigation for Bidirectional Electric Vehicle (EV) Charging System Equipment

2.2.6 DIN Publications

Copies of these documents are available online at https://www.en-standard.eu/din-standards/.

DIN SPEC 70121	Electromobility - Digital communication between a d.c. EV charging station and an electric vehiclefor control of d.c. charging in the Combined Charging System
DIN SPEC 70122	Conformance tests for digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging in the Combined Charging System;
DIN SPEC 91286	DIN SPEC 91286:2011-11 Electric mobility - Schemes of identifiers for E-Roaming -Contract ID and Electric Vehicle Supply Equipment ID

2.2.7 Sunspec Modbus

Available from Sunspec Organization

https://sunspec.org/sunspec-modbus-specifications/

SunSpec DER Information Model Specification

3. DEFINITIONS

3.1 ADVANCED METERING INFRASTRUCTURE (AMI)

This typically refers to the full measurement and collection system that includes meters at the customer site, communication networks between the customer and a service provider, such as an electric, gas, or water utility, and data reception and management systems that make the information available to the service provider.

3.2 BATTERY

See electric vehicle storage battery (3.10).

3.3 BATTERY ELECTRIC VEHICLE (BEV)

A vehicle that receives its power solely from batteries, unlike a hybrid vehicle that may receive a portion of its power from an internal combustion engine (ICE). See also PEV (3.16).

3.4 BRANCH CIRCUIT

The circuit conductors between the final overcurrent device protecting the circuit and the equipment supplied by the circuit. It is typically an unswitched circuit from the service equipment (fuse box) to an appliance. For this application, the appliance is the electric vehicle supply equipment (EVSE).

3.5 COMPATIBILITY CHECK

The PEV and the off-board charger should check if they are compatible. For example, the PEV RESS voltage may be higher than what the DC supply can support. Another example is where the PEV RESS maximum voltage is lower than what the DC supply can regulate down to. The vehicle will evaluate the DC supply limit parameters and the vehicle decides whether to proceed with charging. Also see conformance (3.6) and interoperability (3.13).

3.6 CONFORMANCE

A statement of successful measureable verification that a device has implemented a standard as written. A compatible device may claim it conforms to a standard only after comprehensive conformance testing.

3.7 CONSISTENT OVERHEAD BYTE STUFFING (COBS)

An algorithm for encoding data bytes that results in efficient, reliable, unambiguous packet framing regardless of packet content, thus making it easy for receiving applications to recover from malformed packets.

3.8 DC SUPPLY

It converts AC energy from the grid to the DC energy for the rechargeable energy storage system (RESS). It is also referred as the off-board charger.

3.9 ELECTRIC VEHICLE COMMUNICATION CONTROLLER (EVCC)

This is the module in the PEV that includes the PLC communication signals transmitted and received to the supply equipment communication controller (SECC), within the EVSE.

3.10 ELECTRIC VEHICLE STORAGE BATTERY (BATTERY)

A group of electrochemical cells electrically connected in a series and/or parallel arrangement, the principal purpose of which is to provide DC electrical energy to propel the EV. May also be called rechargeble energy storage system (RESS), or energy storage system (ESS).

3.11 ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)

The equipment from the branch circuit to, and including, the connector that couples to the electric vehicle inlet, the purpose of which is to transfer electric energy to a PEV. This equipment is located off-board the vehicle.

3.12 HANDSHAKING COMPLETE

This is not a signal. This is a state from a combination of several signals between the PEV and the off-board charger. After initiating high level communications, the DC off-board charger must receive: vehicle ready, vehicle maximum current limit, vehicle voltage upper limit and vehicle error code. The PEV must receive: charger maximum current limit, charger maximum voltage limit, charger minimum current limit, and charger minimum voltage limit and charger status code. The vehicle must confirm the connector lock status and will implicitly reflect the lock state in the vehicle ready status. The lock status is not explicitly sent from the vehicle to the DC off-board charger. After all of these signals have been exchanged between the PEV and the off-board DC charger then handshaking complete state is reached.

3.13 INTEROPERABILITY

The capability of a standards conforming device to function as intended with other standards conforming devices without special effort by the user.

3.14 MESSAGE

A message may include several signals packaged together in a group such that the entire group can be sent together over a physical layer interface. The physical layer will be defined in the SAE J2931 documents.

3.15 NO DATA PARAMETER

This defines a means for the vehicle or DC supply to indicate that a signal is not available (i.e., hasn't been read yet).

3.16 PLUG-IN ELECTRIC VEHICLE (PEV)

Any class of vehicle: BEV, plug-in hybrid electric vehicle (PHEV), electric tug, etc., which can be plugged in to receive power from the electrical grid where this power is then used to apply traction to the vehicle wheels.

3.17 POWER LINE COMMUNICATION (PLC)

This is called power line carrier, mains communication, power line telecom (PLT), or power line networking (PLN), are terms describing several different systems for using electric power lines to carry information over the power line.

Electrical power is transmitted over high voltage transmission lines, distributed over medium voltage, and used inside buildings at lower voltages. Power line communications can be applied at each stage. Most PLC technologies limit themselves to one set of wires (for example, premises wiring), but some can cross between two levels (for example, both the distribution network and premises wiring).

All power line communications systems operate by impressing a modulated carrier signal on the wiring system. Different types of power line communications use different frequency bands, depending on the signal transmission characteristics of the power wiring used. Since the power wiring system was originally intended for transmission of AC power, the power wire circuits have only a limited ability to carry higher frequencies. The propagation problem is a limiting factor for each type of power line communications.

Data rates over a power line communication system vary widely. Low-frequency (about 100 to 200 kHz) carriers impressed on high-voltage transmission lines may carry one or two analog voice circuits, or telemetry and control circuits with an equivalent data rate of a few hundred bits per second; however, these circuits may be many miles (kilometers) long. Higher data rates generally imply shorter ranges; a local area network operating at millions of bits per second may only cover one floor of an office building, but eliminates installation of dedicated network cabling.

3.18 PRE-CHARGE

Pre-charging the DC bus ensures that the voltage supplied by the EVSE is nearly matched to the vehicle RESS voltage prior to closing the vehicle contactors. This ensures that there is no possibility of a high in-rush current at the time of contactor closure.

3.19 RECHARGEABLE ENERGY STORAGE SYSTEM (RESS)

Any energy storage system that has the capability to be charged and discharged. (Examples: batteries, capacitors, and electro-mechanical flywheels.)

3.20 SUPPLY EQUIPMENT COMMUNICATION CONTROLLER (SECC)

This is the module in the EVSE that includes the PLC communication signals transmitted and received to the EVCC, within the PEV.

3.21 SIGNAL

The individual data elements that are communicated between the Plug-In Vehicle and the off-board charger. The signals are listed in 4.1.3 and in the table in Appendix B.

3.22 SIGNAL BIT SIZE

The bit size defines how many digital bits are needed to represent the full range signal, including no data.

3.23 SIGNAL DEFAULT VALUE

The default value is what is assumed if a signal has not yet been received over the communications bus.

3.24 SIGNAL OFF-SET

This defines how an integer is adjusted to achieve the full range at the defined resolution. Offset can be positive or negative.

3.25 SIGNAL RANGE

The range defines the signal limits in engineering units.

3.26 SIGNAL RESOLUTION

The resolution determines how much a signal can change with each bit step in the integer representation.

3.27 SIGNAL UPDATE RATE

This defines the expected frequency at which a periodic signal must be received over the communications bus for proper system control. If a particular signal is missing for more than ten full rate cycles (based on 5.6.2), then the system should enter a faulted state and proceed to shutdown energy transfer.

DC off-board charger must receive: vehicle ready, vehicle maximum current limit, vehicle voltage upper limit and vehicle error code.

3.28 STATE OF CHARGE (SOC) (%)

Obtained by subtracting the depth of discharge from 100.

3.29 UART

A hardware communication protocol that uses asynchronous serial communication with configurable speed. Asynchronous means there is no clock signal to synchronize the output bits from the transmitting device going to the receiving end

3.30 V1G

A form of managed charging in which the charging (power level and time of charge) is adjusted to meet the prioritized needs of the EV owner and the grid.

3.31 VEHICLE-TO-GRID (V2G)

A form of managed charging, where, in addition to adjusting charging behavior (V1G), a vehicle RESS can discharge to the utility grid. The charging time, charging power level, discharge time, and discharge power levels are all manageable in order to meet the prioritized needs of the EV owner and the grid.

3.32 VEHICLE-TO-HOME (V2H)

An inverter intended to provide electrical energy to a load not associated with the electric utility or grid. Generally applied only to V2H or V2L situations and not V2G.

4. TECHNICAL REQUIREMENTS

4.1 Charging Phases

Refer to Appendices F and G in the SAE J1772 document for details about the charging phases. A normal charging session is broken up into four phases: (1) initialization, (2) pre-charge, (3) energy transfer, and (4) shutdown. Additionally, there are three types of emergency shutdown: (1) vehicle initiated, (2) supply initiated, and (3) cord disconnection.

4.1.1 Message Sequences

[V2G-DC-005] The basic signaling follows SAE J1772. All the timings shall be compliant with SAE J1772.

During the charging process, a bidirectional signaling according to SAE J1772 is used to indicate EV-related information via control pilot (CP) states and EVSE-related information via the CP duty cycle.

Message sequences are defined for several scenarios in SAE J1772, Appendix F:

- Normal startup
- Normal shutdown
- Vehicle initiated shutdown
- Charger initiated shutdown
- Loss of pilot shutdown

[V2G-DC-560] For DC charging, the EV shall apply CP State C or D during the energy transfer and CP State B otherwise, unless an error condition occurring at any point in time requires changing to CP State B. For more details, please see [V2G-DC-501] and [V2G-DC502].

[V2G-DC-561] An EVSE that supports only DC charging on a connector shall apply a CP duty cycle of 5 % on this connector after detection of CP State B, so that the high-level communication can start, and until high-level communication stops, unless an error condition requires applying a different CP duty cycle or CP voltage.

NOTE 1: An EVSE that supports other charging types than DC charging on a connector may, in accordance with the specification of those charging types, apply other CP duty cycles, including 100 %, on this connector until it sends a ChargeParameterDiscoveryRes message with ResponseCode equal to “OK.” Please see [V2G-DC-671].

NOTE 2: According to SAE J1772, if the SECC detects CP State A or an unexpected CP State B, it carries out, without any delay, an “EVSE-initiated emergency shutdown,” which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

4.1.2 Charging Limits

Throughout the charging session the vehicle and DC charger will both communicate their respective operation limits. These limits include the maximum and minimum for current, maximum voltage and maximum power. The charger will regulate its output control to maintain these limits.

Figure 2 shows how those limits are to be maintained at a few sample operating points.

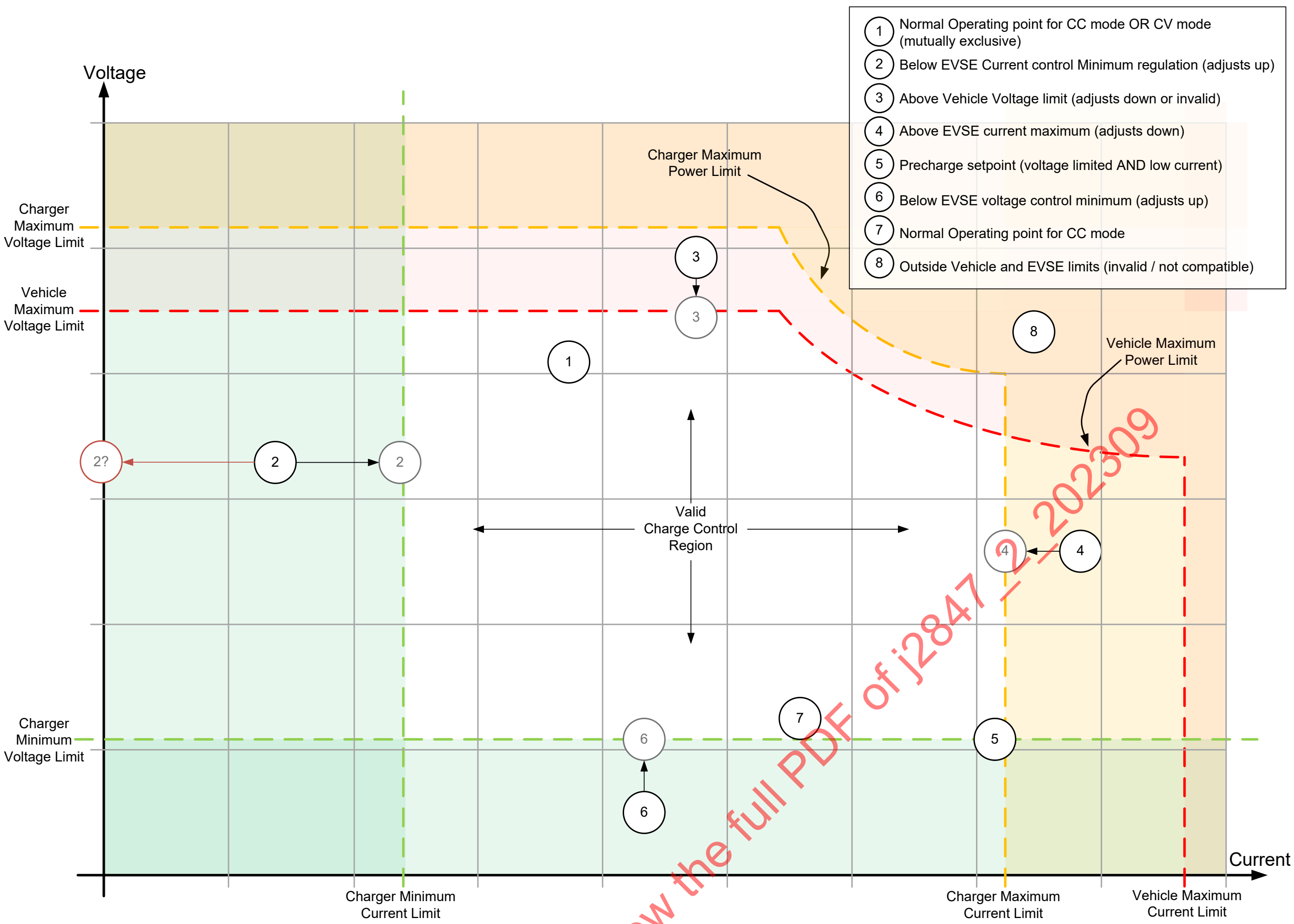


Figure 2 - Charging limits

4.1.3 Requirement Structure

4.1.3.1 Requirement Format

This document uses a requirement structure; i.e., a unique number that identifies each individual requirement included in this clause. This requirement structure allows for easier requirement tracking and test case specification. The following formats are used:

"**[V2G-DC-xyz]** requirement text," where:

- "V2G-DC" represents the DIN SPEC 70121 standard.
- "xyz" represents the individual requirement number.
- "requirement text" represents the actual text of the requirement.

Example:

[V2G-DC-001] This shall be an example.

4.1.3.2 Applicability

This clause specifies the requirements to be implemented by the EV and the EVSE in order to allow communication between both entities. Usually the requirements of this standard are implemented by one vehicle entity and additionally at least by one EVSE entity depending on the EVSE network architecture.

The requirements of this specification will refer to as “The EV shall implement…” implying that the vehicle communication entity shall implement the required functionality if not explicitly stated otherwise.

The requirements of this specification will refer to as “The EVSE shall implement…” implying that at least one EVSE entity shall implement the required functionality if not explicitly stated otherwise.

The requirements of this specification will refer to as “The V2G entities shall implement…” implying that all V2G entities involved in the V2G communication shall implement the required functionality if not explicitly stated otherwise.

[V2G-DC-001] The EV shall implement all mandatory requirements defined in this document for an EV.

[V2G-DC-002] The EVSE shall implement all mandatory requirements defined in this document for an EVSE.

4.1.3.3 Usage of Request for Comment (RFC) References

When RFCs are referenced, all “must/must not” requirements are mandatory.

[V2G-DC-003] If a referenced RFC has been updated by one or several RFC, the update is fully applicable for this standard.

[V2G-DC-004] If an update or part of an update applicable to an RFC referenced herein is not compatible with the original RFC or the implementation described by this standard the update shall not apply.

4.2 Signal Definitions

This section describes the details of the signals used to control an off-board charger. Several signals will be combined together to form an EXI encoded XML schema (see Section 6). The message packaging structure is outside the scope of this document in this current revision.

See the message list table in 5.2 for the messages containing these signals. See Table B1 in Appendix B for signal details.

4.2.1 App Protocol (AppProtocol)

Source: EVCC
Destination:SECC

This message element is used by the EVCC for transmitting the list of supported protocols. Each protocol with a particular version supported by the EVCC is represented by one AppProtocol entry in the request message (maximum number of entries: 20).

Table 1 - AppProtocol entry

Element/Attribute Name	Type	Semantics
AppProtocol	complexType: includes the message elements defined in this table	This message element is used by the EVCC for transmitting the list of supported protocols. Each protocol with a particular version supported by the EVCC is represented by one AppProtocol entry in the request message (maximum number of entries: 20).

4.2.2 Bulk Charging Complete (BulkChargingComplete)

Source: EVCC
Destination:SECC

This signal represents that the RESS has reached the bulk charge level (generally up to 80 to 100% SOC). This is optional, and is used for display purposes on the charging station. See 4.1 for more details. Indicates that the RESS system has completed the high-power charging.

Table 2 - Bulk charging complete

Element/Attribute Name	Type	Semantics
BulkChargingComplete	simpleType: boolean	Optional Element: If set to TRUE, the EV indicates that bulk charge (approx. 80 % SOC) is complete.

4.2.3 Bulk SOC (BulkSOC)

Source: EVCC
Destination: SECC

This signal represents the end point (SOC) where optimum fast charge ends. Each vehicle OEM will decide the bulk level value (80% for example). The displayed SOC could indicate this from actual SOC to bulk percent if desired.

Table 3 - Bulk SOC

Element/Attribute Name	Type	Semantics
BulkSOC	simpleType: percentValueType byte (range: 0-100)	Optional Element: SOC at which the PEV considers a fast charging process to complete.

4.2.4 Charge Service (ChargeService)

Source: SECC
Destination: EVCC

Available charging services supported by the EVSE. See 4.2.91 for additional signal details.

Table 4 - Charge service

Element/Attribute Name	Type	Semantics
ChargeService	complexType: ServiceChargeType	Available charging services supported by the EVSE.

4.2.5 Charging Complete (ChargingComplete)

Source: EVCC
Destination: SECC

This signal indicates that the RESS has reached the full charge level (up to 100% SOC). The status is reported to the DC supply for presentation in a display. Note that the charge process may continue with energy transfer to support vehicle accessory loads (cabin conditioning, RESS conditioning, etc.) after this signal transitions to TRUE.

Table 5 - Charging complete

Element/Attribute Name	Type	Semantics
ChargingComplete	simpleType: boolean	If set to TRUE, the EV indicates that full charge (100 % SOC) is complete.

4.2.6 Charging Profile (ChargingProfile)

Source: EVCC
Destination: SECC

This signal represents available charging services supported by the EVSE.

[V2G-DC-303] The SECC and the EVCC shall implement this type as defined in Figure 3.

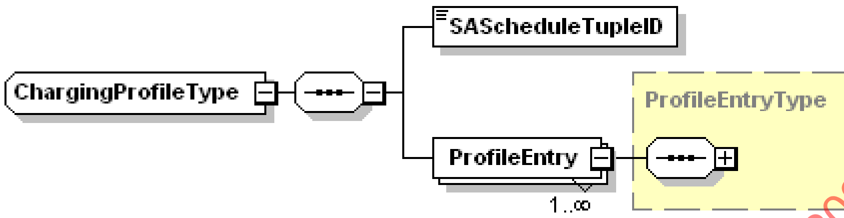


Figure 3 - XML schema definition for the ChargingProfileType

Table 6 - Charging profile

Element/Attribute Name	Type	Semantics
ChargingProfile	complexType: ChargingProfileType	Optional Element: Charge reservation of the EV as maximum amount of power drawn over time for this charging session.

[V2G-DC-266] The SECC shall always accept the ChargingProfile of the EVCC if it does not exceed the PMax values of all PMaxScheduleEntry elements according to the chosen SAScheduleTuple element in the charge parameter discovery response message.

[V2G-DC-267] The SECC shall send the negative response code FAILED_ChargingProfileInvalid in the PowerDelivery response message if the EVCC sends a ChargingProfile which is not adhering to the PMax values of all PMaxScheduleEntry elements according to the chosen SAScheduleTuple element in the charge parameter discovery response message.

4.2.7 Charging Profile Entry Max Power (ChargingProfileEntryMaxPower)

Source: EVCC
Destination: SECC

Table 7 - Charging profile entry max power

Element/Attribute Name	Type	Semantics
ChargingProfileEntryMaxPower	simpleType: PMaxType short	Maximum power in Watts consumed by the EV within the current charging profile entry (beginning from ChargingProfileEntryStart).

[V2G-DC-313] The value of the ChargingProfileEntryMaxPower element shall be defined as maximum power in Watts consumed by the EV within the active period of an element of type ProfileEntryType.

[V2G-DC-314] The values of the ChargingProfileEntryMaxPower element shall be equal to or smaller than the limits in the respective elements of the PMaxScheduleType provided in the charge parameter discovery response message.

4.2.8 Charging Profile Entry Start (ChargingProfileEntryStart)

Source: EVCC
Destination: SECC

Table 8 - Charging profile entry start

Element/Attribute Name	Type	Semantics
ChargingProfileEntryStart	simpleType unsignedInt	Time when chargingProfileEntry starts to be valid. Offset in seconds from NOW.

[V2G-DC-310] The value of the ChargingProfileEntryStart element shall be defined as the point in time when this element of ProfileEntryType starts to be active.

[V2G-DC-311] The value of the next ChargingProfileEntryStart element in the list of elements of ProfileEntryType shall be defined as the point in time when this element of ProfileEntryType becomes inactive.

NOTE: [V2G-DC-310] and [V2G-DC-311] define the period of time an element of ProfileEntryType is active.

[V2G-DC-312] The last element in the list of elements of type ProfileEntryType is active until the list is updated.

4.2.9 Contract (Contract)

Source: EVCC
Destination: SECC

Not used for DC charging. See 4.2.85.

4.2.10 Date Time Now (DateTimeNow)

Source: SECC
Destination: EVCC

This signal represents the timestamp of the current time using the unix time stamp format. This signal is used by the vehicle to check the validity of the certificates for contract based charging and as an external time reference. Based on this information, the vehicle might implement a strategy when certificate updates are required. Using this signal avoids requiring the time base of the vehicle and EVSE to be synchronized.

Table 9 - Date time now

Element/Attribute Name	Type	Semantics
DateTimeNow	simpleType long	Optional Element: Timestamp of the current SECC time using the unix time stamp format.

4.2.11 DC EV Charge Parameter (DC_EVChargeParameter)

Source: EVCC
Destination: SECC

Table 10 - DC EV charge parameter

Element/Attribute Name	Type	Semantics
DC_EVChargeParameter	complexType: DC_EVChargeParameterType substitutes abstract type EV_ChargeParameterType	This element is used by the EVCC for initiating the target setting process for DC charging.

4.2.12 DC EV Charge Parameter Type (DC_EVChargeParameterType)

Source: EVCC
Destination: SECC

[V2G-DC-351] The EVCC and the SECC shall implement this type as defined in Figure 4.

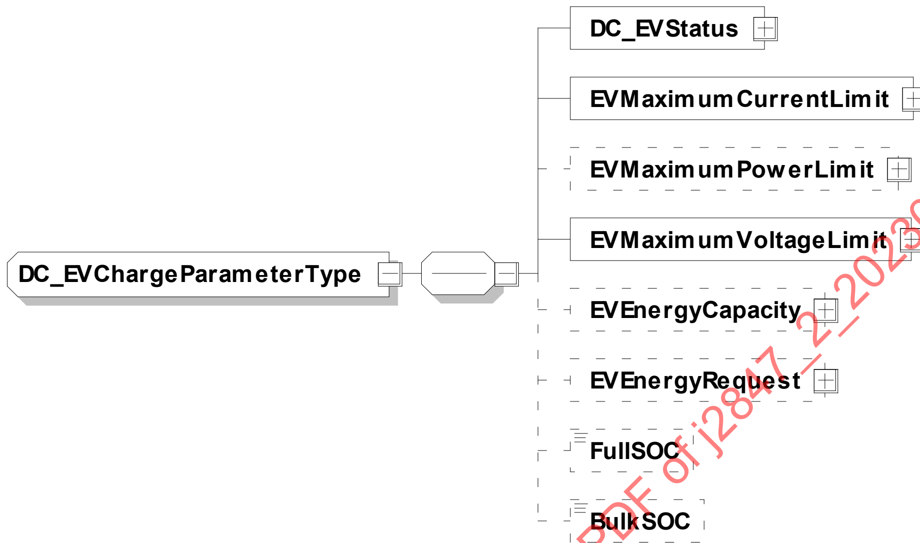


Figure 4 - Schema diagram—DC_EVChargeParameterType

4.2.13 DC EV Power Delivery Parameter (DC_EVPowerDeliveryParameter)

Source: EVCC
Destination: SECC

Table 11 - DC EV power delivery parameter

Element/Attribute Name	Type	Semantics
DC_EVPowerDeliveryParameter	complexType: DC_EVPowerDeliveryParameterType substitutes abstract type EVPowerDeliveryParameter	Optional Element: This element is used by the EVCC for transmitting the parameters for power delivery. NOTE: In the scope of SAE, this optional element shall be used.

[V2G-DC-558] In the scope of SAE, the optional element "DC_EVPowerDeliveryParameter" shall be used.

4.2.14 DC EV Power Delivery Parameter Type (DC_EVPowerDeliveryParameterType)

Source: EVCC
Destination: SECC

[V2G-DC-355] The EVCC and the SECC shall implement this type as defined in Figure 5.

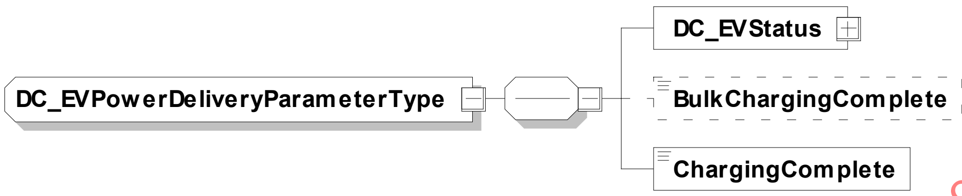


Figure 5 - Schema diagram—DC_EVPowerDeliveryParameterType

[V2G-DC-356] The message element shall be used.

4.2.15 DC EV Status (DC_EVStatus)

Source: EVCC
Destination: SECC

Table 12 - DC EV status

Element/Attribute Name	Type	Semantics
DC_EVStatus	complexType DC_EVStatusType	Current status of the EV.

4.2.16 DC EV Status Type (DC_EVStatusType)

Source: EVCC
Destination: SECC

[V2G-DC-348] The EVCC and the SECC shall implement this type as defined in Figure 6.

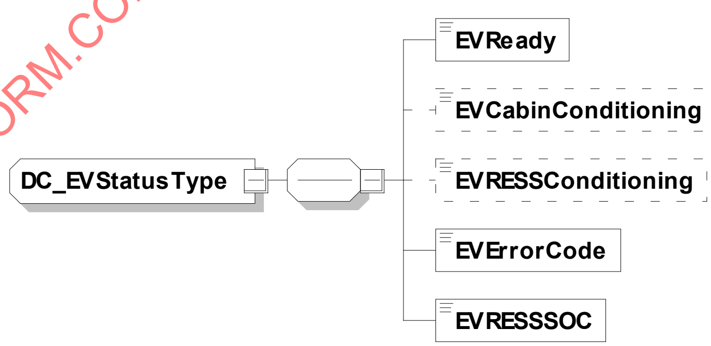


Figure 6 - Schema diagram—DC_EVStatusType

4.2.17 DC EVSE Charge Parameter (DC_EVSEChargeParameter)

Source: SECC
Destination: EVCC

Table 13 - DC EVSE charge parameter

Element/Attribute Name	Type	Semantics
DC_EVSEChargeParameter	complexType: DC_EVSEChargeParameterType substitutes abstract type EVSE_ChargeParameterType	This element is used by the SECC for initiating the target setting process for DC charging

4.2.18 DC EVSE Charge Parameter Type (DC_EVSEChargeParameterType)

Source: SECC
Destination: EVCC

[V2G-DC-353] The EVCC and the SECC shall implement this type as defined in Figure 7.

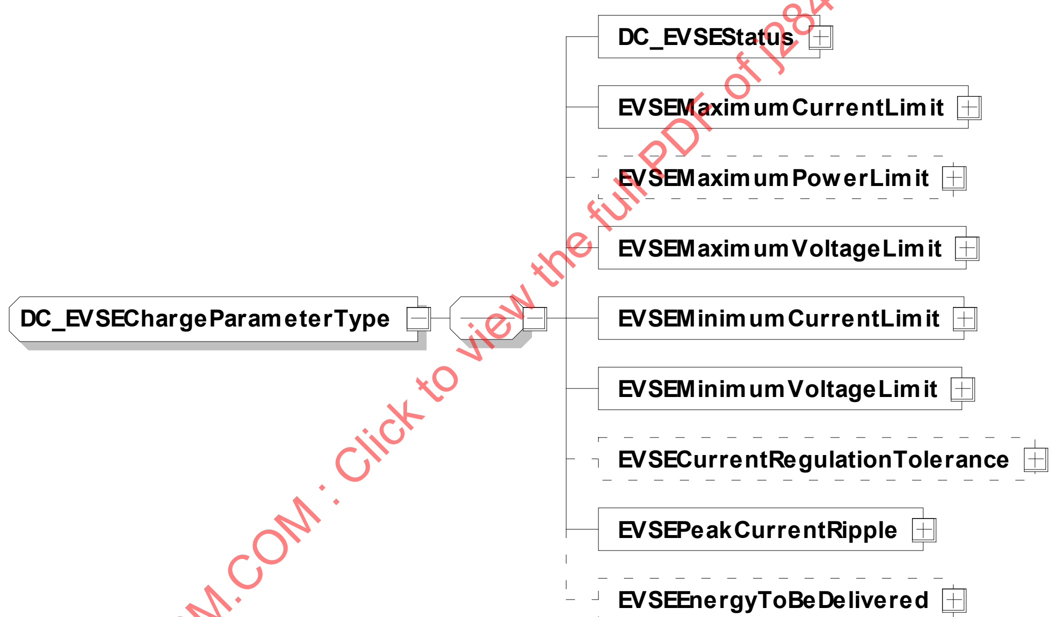


Figure 7 - Schema diagram—DC_EVSEChargeParameterType

4.2.19 DC EVSE Status (DC_EVSEStatus)

Source: SECC
Destination: EVCC

Table 14 - DC EVSE status

Element/Attribute Name	Type	Semantics
DC_EVSEStatus	complexType: DC_EVSEStatusType substitutes abstract type EVSE_StatusType	This element is used by the SECC for indicating the SECC status. Current status of the EVSE.

4.2.20 DC EVSE Status Type (DC_EVSEStatusType)

Source: SECC
Destination: EVCC

[V2G-DC-344] The EVCC and the SECC shall implement this type as defined in Figure 8.

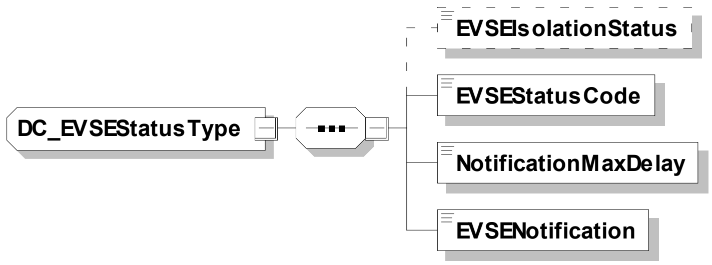


Figure 8 - Schema diagram—DC_EVSEStatusType

[V2G-DC-639] For DC charging, the elements EVReady, EVCabinConditioning, and EVRESSConiditioning shall not affect the charging session. However, they may be used for customer information.

4.2.21 Duration (Duration)

Source: SECC
Destination: EVCC

Table 15 - Duration

Element/Attribute Name	Type	Semantics
duration	simpleType unsignedInt	Optional Element: Duration of the interval, in seconds.

[V2G-DC-338] The value of the duration element shall be defined as a period of time in seconds.

[V2G-DC-339] The duration element shall only be used for the last interval of the PMaxSchedule.

NOTE: It indicates the end of the coverage time of the delivered PMaxSchedule information.

4.2.22 Energy Transfer Type (EnergyTransferType)

Source: SECC
Destination: EVCC

Table 16 - Energy transfer type

Element/Attribute Name	Type	Semantics
EnergyTransferType	simpleType: EVSESupportedEnergyTransferType enumeration	Available charging types or methods supported by the EVSE.

The definition of the EVSESupportedEnergyTransferType supports connectors Configuration CC (corresponding to Type 1), Configuration DD (corresponding to Type 2), Configuration EE, and Configuration FF. Based on the supported connectors, the SECC can offer charging services as defined in Table 1.

[V2G-DC-296] The SECC shall use the EVSESupportedEnergyTransferType as described in Table 1.

Table 17 - Semantics for EVSESupportedEnergyTransferType

EnergyTransferType	Offered charging service.
AC_single_phase_core	Not used in the scope of SAE
AC_three_phase_core	Not used in the scope of SAE.
DC_core	EVSE supports DC charging using the core pins of a Configuration CC connector (corresponding to a Type 1 connector) or of a Configuration DD connector (corresponding to a Type 2 connector).
DC_extended	EVSE supports DC charging using the extended pins of a Configuration EE or Configuration FF connector.
DC_combo_core	Not used in the scope of SAE.
DC_dual	Not used in the scope of SAE.
AC_core1p_DC_extended	Not used in the scope of SAE.
AC_single_DC_core	Not used in the scope of SAE.
AC_single_phase_three_phase_core_DC_extended	Not used in the scope of SAE.
AC_core3p_DC_extended	Not used in the scope of SAE.

[V2G-DC-630] If the EVSE supports DC charging using the extended pins of a vehicle connector according to SAE J1772 or IEC 62196 Configuration EE or Configuration FF, the SECC shall transmit “DC_extended” in EnergyTransferType.

[V2G-DC-631] If the EVSE supports DC charging using the core pins of an connector according to Configuration CC (corresponding to Type 1) or according to Configuration DD (corresponding to Type 2), the SECC shall transmit “DC_core” in EnergyTransferType.

[V2G-DC-632] The SECC shall not transmit values other than “DC_extended” and “DC_core” in EnergyTransferType.

4.2.23 EV Cabin Conditioning (EVCabinConditioning)

Source: EVCC
Destination:SECC

This signal represents a Boolean state that informs the charger that the EVCC is performing some type of cabin conditioning. This can be used for display purposes on the charge station.

Table 18 - EV cabin conditioning

Element/Attribute Name	Type	Semantics
EVCabinConditioning	simpleType: boolean	Optional Element: Vehicle Cabin Conditioning, The EV is using energy from the DC supply to heat or cool the passenger compartment.

[V2G-DC-639] For DC charging, the elements EVReady, EVCabinConditioning, and EVRESSConiditioning shall not affect the charging session. However, they may be used for customer information.

4.2.24 EV Energy Capacity (EVEnergyCapacity)

Source: EVCC
Destination: SECC

This signal indicates the maximum designed energy capacity allowed by the vehicle manufacturer. The DC supply could use this signal for safety mitigation from the charger side. Charger may optionally stop after delivering this amount of energy the vehicle would accept. That value includes RESS capacity and vehicle auxiliary energy.

Table 19 - EV energy capacity

Element/Attribute Name	Type	Semantics
EVEnergyCapacity	complexType	Optional Element:

	PhysicalValueType	Maximum energy capacity supported by the EV.

4.2.25 EV Energy Request (EVEnergyRequest)

Source: EVCC
Destination: SECC

This signal provides the EVSE with an indication of the amount of energy that will be requested during the current charging session.

Table 20 - EV energy request

Element/Attribute Name	Type	Semantics
EVEnergyRequest	complexType PhysicalValueType	Optional Element: Amount of energy the EV requests from the EVSE.

[V2G-DC-642] In the scope of SAE, if the element "EVEnergyRequest" is contained the message ChargeParameterDiscoveryReq, it shall represent the maximum amount of energy that the EV will request (by means of CurrentDemandReq) throughout the entire charging process.

NOTE: If the element "EVEnergyRequest" is contained in the message ChargeParameterDiscoveryReq, this allows the EVSE to compute suitable PMaxSchedules and perform energy management functions.

4.2.26 EV Error Code (EVErrorCode)

Source: EVCC
Destination: SECC

This signal indicates the PEV internal error state that will inhibit/abort charging. This is for display purposes only to guide the user through the charging process for the particular vehicle. Not all vehicle manufacturers will have this feature.

In situations where a vehicle might have more than one state from the list below, the vehicle (or OEM) will determine the highest priority item to send to the charger for display. Only one item from the list can be sent in this signal.

This signal may contain any value defined by the enumerated type DC_EVErrorCodeType. The value and meaning of each enumeration is described in the table below.

Table 21 - EV error code

Element/Attribute Name	Type	Semantics
EVErrorCode	simpleType: DC_EVErrorCodeType enumeration	Indicates the EV internal status. See Table 2 for details.

[V2G-DC-350] The EVCC shall use the EVErrorCodes as described in Table 2.

Table 22 - Semantics and type definition for EVErrorCodeType

Element Name	Semantics
NO_ERROR	Default value, when EV has no error detected.
FAILED_RESSTemperatureInhibit	Battery temperature Inhibit, battery too hot/cold to accept charge.
FAILED_EVShiftPosition	Vehicle shift position, vehicle is not in park.
FAILED_ChargerConnectorLockFault	Charger connector lock fault, Vehicle has not detected the charge cord connector locked into the inlet or a failure exists where connector cannot be unlocked from the charging inlet.
FAILED_EVRESSMalfunction	Vehicle RESS malfunction, Any non-recoverable fault or error condition of the vehicle RESS.
FAILED_ChargingCurrentdifferential	Charging current differential, Indication that vehicle has stopped the communication session after detecting that the charging station is not able to maintain an output current that fulfills the current request.
FAILED_ChargingVoltageOutOfRange	Charging voltage out of range, Indication that vehicle has stopped the communication session after detecting that the RESS is either under or above the normal operating voltage range.
Reserved A-C	Reserved by ISO/IEC for future use.
FAILED_ChargingSystemIncompatibility	Charging system incompatibility, if the vehicle determines that the charging station is incompatible. Using this value is optional; as an alternative, the vehicle can use EVReady in DC_EVStatusType equal to “FALSE.”
NoData	No data. Only used when vehicle has not yet determined its operating state.

[V2G-DC-640] All EVErrorCodes in Table 2 for which there are no explicit requirements in this document are for information purpose only. They may be used for information to the customer, but they shall not influence the EVSE charging process.

NOTE: In the context of SAE this means that the EVSE shall not change its behavior based on the value of EVErrorCode. If the EV detects a situation that requires a termination of the charging process, the EV will use other means to execute this shutdown, e.g., ramp down the current request, or, in case an emergency shutdown is required, change to CP State B in accordance with SAE J1772. In all other cases, the expected value for EVErrorCode is “NO_ERROR.”

4.2.27 EV ID (EVCCID)

Source: EVCC
Destination: SECC

This signal tells the EVSE the unique identification number of a vehicle. It contains the HPGP Ethernet MAC address of the vehicle.

Table 23 - EV ID

Element Name	Type	Semantics
EVCCID	simpleType: evccIDType hexBinary (max length: 8)	Specifies the EV’s identification in a readable format. It contains the MAC address of the EVCC as six hex binary encoded bytes; i.e., the element shall have a length of six bytes.

4.2.28 EV Maximum Current Limit (EVMaximumCurrentLimit)

Source: EVCC
Destination: SECC

This is a signal from the vehicle to the DC supply indicating its maximum allowed current. In other words, it's the maximum current limit allowed by the vehicle. It may depend on RESS temperature, SOC, etc. The charger shall not exceed the minimum of this signal and the charger maximum current limit. The primary purpose of the current limit signal is for the DC charger to regulate its fast internal (ms) regulation loops. The DC supply hardware and software shall control the output so that there will be no violations of this limit. The vehicle may optionally change this signal dynamically throughout the charging session.

Table 24 - EV maximum current limit

Element/Attribute Name	Type	Semantics
EVMaximumCurrentLimit	complexType PhysicalValueType	Maximum current supported by the EV.

NOTE: For details on the processing of EVMaximumCurrentLimit and EVMaximumVoltageLimit by the EVSE, please see 4.2.42 and 4.2.44.

4.2.29 EV Maximum Power Limit (EVMaximumPowerLimit)

Source: EVCC
Destination: SECC

This signal represents the maximum power limit allowed by the vehicle. It may depend on RESS temperature, SOC, etc. The charger shall not exceed the minimum of this signal and the charger maximum power limit. The primary purpose of the Power Limit signal is for the DC charger to regulate its fast internal (ms) regulation loops. The vehicle may optionally change this signal dynamically throughout the charging session.

Table 25 - EV maximum power limit

Element/Attribute Name	Type	Semantics
EVMaximumPowerLimit	complexType PhysicalValueType	Optional Element: Maximum power supported by the EV.

[V2G-DC-641] In the scope of SAE, if the element "EVMaximumPowerLimit" is contained within the message ChargeParameterDiscoveryReq, it shall represent the maximum power that the EV will request (by means of CurrentDemandReq) at any time during the charging process. The value of EVMaximumPowerLimit that is sent in any CurrentDemandReq message shall not exceed the value of EVMaximumPowerLimit that is sent in the ChargeParameterDiscoveryReq message.

NOTE: If the element "EVMaximumPowerLimit" is contained in the message ChargeParameterDiscoveryReq, this allows the EVSE to compute suitable PMaxSchedules.

4.2.30 EV Maximum Voltage Limit (EVMaximumVoltageLimit)

Source: EVCC
Destination: SECC

This signal represents the maximum voltage limit allowed by the vehicle. The value may depend on Inlet rating, RESS temperature, SOC, etc. The charger shall not exceed the minimum of this signal and the charger maximum voltage limit. The primary purpose of the voltage limit signal is for the DC charger to regulate its fast internal (ms) regulation loops. The vehicle may optionally change this signal dynamically throughout the charging session.

When the vehicle needs to use constant voltage mode, this signal will be adjusted by the vehicle RESS controls to maintain a constant voltage around a low current.

Table 26 - EV maximum voltage limit

Element/Attribute Name	Type	Semantics
EVMaximumVoltageLimit	complexType PhysicalValueType	Optional Element: Maximum voltage supported by the EV.

NOTE: For details on the processing of "EVMaximumCurrentLimit" and "EVMaximumVoltageLimit" by the EVSE, please see 4.2.42 and 4.2.44.

4.2.31 EV Ready (EVReady)

Source: EVCC
Destination: SECC

This signal informs the charger that the PEV is ready to be charged. It is needed if there is no control pilot signal. It's redundant to control pilot signal.

Table 27 - EV ready

Element/Attribute Name	Type	Semantics
EVReady	simpleType: boolean	If set to TRUE, the EV is ready to charge.

[V2G-DC-639] For DC charging, the elements EVReady, EVCabinConditioning, and EVRESSConiditioning shall not affect the charging session. However, they may be used for customer information.

4.2.32 EV Requested Energy Transfer Type (EVRequestedEnergyTransferType)

Source: EVCC
Destination: SECC

Table 28 - EV requested energy transfer type

Element Name	Type	Semantics
EVRequestedEnergyTransferType	simpleType: EVRequestedEnergyTransferType enumeration	Selected energy transfer type for charging that is requested by the EVCC.

This signal informs the DC supply of the type of energy transfer that the EVCC wishes to perform. This allows a vehicle to connect to an EVSE that can provide either DC or AC energy transfer.

This signal allows the vehicle to select its desired energy transfer type in the case that both the EVSE and vehicle support multiple energy transfer types and SAE J1772 connector variations (AC, DC type 1, DC combo). The charging station should confirm that it is capable of supporting the requested type, and should only complete handshaking if it is compatible.

This signal may contain any value defined by the enumerated type EVRequestedEnergyTransferType. The value and meaning of each enumeration is described in the table below. This signal may contain any value defined by the enumerated type EVSESupportedEnergyTransferType. The value and meaning of each enumeration is described in Table 29.

Table 29 - Value defined by the enumerated type EVSESupportedEnergyTransferType

XML Enumeration	Comments/Description
AC_single_phase_core	Vehicle is requesting single phase AC energy transfer on core pins as specified through the SAE J1772 type 1 or type 2 connector.
AC_three_phase_core	Vehicle is requesting three phase AC energy transfer as specified through the SAE 1772 type 1 or type 2 connector on Type 2 core pins.
DC_core	Vehicle is requesting DC energy transfer as specified through the SAE 1772 type 1 or type 2 connector using the standard core connector pins (couple type C1).
DC_extended	Vehicle is requesting DC energy transfer as specified through the SAE 1772 type 1 or type 2 combo connector over the additional pins outside the core (coupler type C2).
DC_combo_core	Vehicle is requesting DC energy transfer as specified through the SAE 1772 type 1 or type 2 combo connector over the core pins (coupler type C2).
DC_unique	In the case of a dedicated coupler for Level 3 DC charging (coupler type C3).

[V2G-DC-623] If the EV requests DC charging using the extended pins of a vehicle connector Configuration EE or Configuration FF, the EVCC shall transmit “DC_extended” in EVRequestedEnergyTransferType.

[V2G-DC-624] If the EV requests DC charging using the core pins of an connector Configuration CC (corresponding to Type 1) or according to Configuration DD (corresponding to Type 2), the EVCC shall transmit “DC_core” in EVRequestedEnergyTransferType.

[V2G-DC-625] The EVCC shall not transmit values other than “DC_extended” and “DC_core” in EVRequestedEnergyTransferType.

4.2.33 EV RESS Conditioning (EVRESSConditioning)

Source: EVCC
Destination: SECC

This signal represents a Boolean state that informs the charger that the EVCC is performing some type of HV battery thermal conditioning. This can be used for display purposes on the charge station.

Table 30 - EV RESS conditioning

Element/Attribute Name	Type	Semantics
EVRESSConditioning	simpleType: boolean	Optional Element: Vehicle RESS conditioning. The vehicle is using energy from the DC charger to condition the RESS to a target temperature.

4.2.34 EV RESS SOC (EVRESSSOC)

Source: EVCC
Destination: SECC

This signal is defined by the vehicle manufacture to represent the relative charge level as a percentage of the full energy storage of the vehicle RESS. It's primarily used for display on the charging supply. If the vehicle uses a battery for energy storage, then this would be battery SOC.

Table 31 - EV RESS SOC

Element/Attribute Name	Type	Semantics
EVRESSSOC	simpleType: percentValueType byte (range: 0-100)	State of charge of the EV's battery (RESS).

[V2G-DC-639] The elements EVReady, EVCabinConditioning, and EVRESSConiditioning shall not affect the charging session. However, they may be used for customer information.

4.2.35 EV Target Current (EVTargetCurrent)

Source: EVCC
Destination: SECC

This signal represents the instantaneous charging current request from the vehicle. The request should be within the established charger and vehicle limits from handshaking. In accordance with SAE J1772, the current request is allowed to be higher than the EVSE maximum current limit but the DC supply will reduce the output to maintain the limit. The DC supply is allowed to overshoot or undershoot around this target as long as it doesn't violate vehicle maximum current limit and the requirements specified in SAE J1772. In the case where any of the EVSE limits have been achieved (current, voltage or power), the charge current request may be higher than the actual measured current reading. Since the vehicle is controlling charge current and reading on-vehicle current sensors, the vehicle will ensure that the request is adjusted to achieve the vehicle control target.

Since it is not always possible to achieve the EV target current being requested and EV target voltage simultaneously, the DC supply will only regulate to one of the requests. The EV should not issue a fault when both cannot be achieved simultaneously.

Table 32 - EV target current

Element/Attribute Name	Type	Semantics
EVTargetCurrent	complexType PhysicalValueType	Instantaneous current requested by the EV.

NOTE 1: If the EVCC wishes to stop the Communication Session for a non-critical reason (e.g., user interaction) after having sent a PowerDeliveryReq message with ReadyToChargeState equal to "TRUE" and before having sent a CurrentDemandReq message, the EVCC, in accordance with [V2G-DC-424], shall send a CurrentDemandReq message, e.g., with EVTargetCurrent equal to 0 A, and wait for a CurrentDemandRes message before continuing according to [V2G-DC-673].

NOTE 2: If the parameter EVSEStatusCode equal to "EVSE_Shutdown" is contained in a PowerDeliveryRes message sent in response to a PowerDeliveryReq message with ReadyToChargeState equal to "TRUE," the EVCC, in accordance with [V2G-DC-424], shall send a CurrentDemandReq message, e.g., with EVTargetCurrent equal to "0 A" (zero ampere), and wait for a CurrentDemandRes message before continuing according to [V2G-DC-673].

4.2.36 EV Target Voltage (EVTargetVoltage)

Source: EVCC
Destination:SECC

This signal tells the charger the target voltage request of the vehicle. This signal shall not exceed the vehicle maximum voltage limit. During the charge process, the EVSE must regulate the current output to close loop around the target voltage as it may be used by the vehicle for voltage control charging. This signal shall be used during the pre-charge Phase of Initialization to command the DC supply voltage to match the RESS.

Since it is not always possible to achieve the PEV charge current request and PEV target voltage simultaneously, the DC supply will only regulate to one of the requests. The PEV should not issue a fault when both cannot be achieved simultaneously.

Table 33 - EV target voltage

Element/Attribute Name	Type	Semantics
EVTargetVoltage	complexType PhysicalValueType	Target Voltage requested by EV.

4.2.37 EVSE Current Limit Achieved (EVSECurrentLimitAchieved)

Source: SECC
Destination: EVCC

This signal represents that the charger is at the limit of its source capability (saturation). The charger becomes saturated when either the charger limits are achieved or the vehicle limits from handshaking have been achieved. It's used by the PEV control to compensate for reaching the limit. This would allow vehicle to refrain from setting a fault when the charger is providing current to the limit of the present operating conditions.

The default state for this signal is FALSE.

Table 34 - EVSE current limit achieved

Element/Attribute Name	Type	Semantics
EVSECurrentLimitAchieved	simpleType boolean	If set to TRUE, the EVSE has reached its current limit.

4.2.38 EVSE Current Regulation Tolerance (EVSECurrentRegulationTolerance)

Source: SECC
Destination: EVCC

This signal represents the DC supply's ability to regulate current with respect to the current request. This signal informs the PEV what absolute magnitude of the DC supply regulation tolerance can be expected at any charge level. This is dependent on the charger filter and control design. It is expected that quick chargers will have a larger tolerance, and may not be suitable for low current topoff charging (bulk level to full level). The vehicle may modify its charging strategy using this information. The vehicle may chose not to initiate the charging session if the value is not compatible with the RESS charging strategy. The vehicle may not support topoff charging if it cannot accept this tolerance of current. The vehicle manufacturer can use this signal to optimize the charging algorithm.

Table 35 - EVSE current regulation tolerance

Element/Attribute Name	Type	Semantics
EVSECurrentRegulationTolerance	complexType PhysicalValueType	Optional Element: Absolute magnitude of the regulation tolerance of the EVSE.

4.2.39 EVSE Energy to be Delivered (EVSEEnergyToBeDelivered)

Source: SECC
Destination: EVCC

This signal represents the allowed or requested units of energy to be delivered during charging (a charging target). This allows public charging stations to limit charging session by limiting the energy transfer (i.e., for a prepaid amount).

Table 36 - EVSE energy to be delivered

Element/Attribute Name	Type	Semantics
EVSEEnergyToBeDelivered	complexType PhysicalValueType	Optional Element: Amount of energy to be delivered by the EVSE

[V2G-DC-643] If the element EVSEEnergyToBeDelivered is contained in the message ChargeParameterDiscoveryRes, it shall represent the amount of energy that the EVSE will be able to provide to the EV throughout the entire charging process.

4.2.40 EVSE ID (EVSEID)

Source: SECC
Destination: EVCC

This signal tells the vehicle the unique identification number of an EVSE.

Table 37 - EVSE ID

Element/Attribute Name	Type	Semantics
EVSEID	simpleType: evseIDType hexBinary (max length: 32)	Any ID that uniquely identifies the EVSE. The format of this message element is defined in DIN SPEC 91286. If an SECC cannot provide such ID data, the value of the EVSEID is set to zero (00 hex).

[V2G-DC-247] The SECC and the EVCC shall use the format for EVSEID.

[V2G-DC-620] The power outlet ID shall use the following pattern: <Power Outlet ID> = DIGIT * 31 (DIGIT/“*”).

[V2G-DC-621] To transform a string-based EVSE ID to hexBinary representation and vice versa, the following conversion rules shall be used for each character and hex digit: “0” <--> 0x0, “1” <--> 0x1, “2” <--> 0x2, “3” <--> 0x3, “4” <--> 0x4, “5” <--> 0x5, “6” <--> 0x6, “7” <--> 0x7, “8” <--> 0x8, “9” <--> 0x9, “*” <--> 0xA, Unused <--> 0xB .. 0xF.

NOTE: Example: The EVSE ID “49*89*6360” is represented as “0x49 0xA8 0x9A 0x63 0x60.”

4.2.41 EVSE Isolation Status (EVSEIsolationStatus)

Source: SECC
Destination: EVCC

This signal informs the PEV the status of the isolation monitoring on the DC supply. This signal is sent to the vehicle periodically throughout the charging session. Consult the SAE J1772 and IEC 61851 part 23 documents for further details regarding the isolation thresholds. Until the first reading has been measured, the DC supply must report the Invalid state.

This signal may contain any value defined by the enumerated type EVSESupportedEnergyTransferType. The value and meaning of each enumeration is described in Table 38 and 39.

Table 38 - EVSE isolation status value

XML Enumeration	Comments/Description
Valid	Isolation measurement confirms the system is within the valid region above thresholds.
Warning	Isolation has detected a measurement below the warning level threshold.
Fault	Isolation has detected a measurement below the fault level threshold.
Invalid	DC supply may transmit this enumeration at startup before measurement has been confirmed.

Table 39 - EVSE isolation status meaning

Element/Attribute Name	Type	Semantics
EVSEIsolationStatus	simpleType: isolationLevelType enumeration	Optional Element: Indicates the isolation condition (result of the isolation test/monitoring). See Table 3 for details.

[V2G-DC-346] The SECC shall use the EVSEIsolationStatus as described in Table 40.

NOTE: For further information on the isolation status, please refer to SAE J1772.

Table 40 - Semantics and types of elements in the IsolationLevelType

Element Name	Semantics
Invalid	An isolation test has not been carried out.
Valid	The isolation test has been carried out successfully and did not result in an isolation warning or fault.
Warning	The measured isolation resistance is below the warning level defined in SAE J1772.
Fault	The measured isolation resistance is below the fault level defined in SAE J1772.

4.2.42 EVSE Maximum Current Limit (EVSEMaximumCurrentLimit)

Source: SECC
Destination: EVCC

This signal represents the maximum current that can be delivered to the PEV. The charger should regulate this value. The charger shall not exceed the minimum of this signal and the vehicle maximum current limit. This value can change dynamically through the charging session.

Table 41 - EVSE maximum current limit

Element/Attribute Name	Type	Semantics
EVSEMaximumCurrentLimit	complexType PhysicalValueType	Optional Element: Maximum current the EVSE can deliver.

4.2.43 EVSE Maximum Power Limit (EVSEMaximumPowerLimit)

Source: SECC
Destination: EVCC

This signal represents the maximum power that can be delivered to the PEV. The charger should regulate this value. The charger shall not exceed the minimum of this signal and the vehicle maximum power limit. The DC supply can dynamically change this value throughout the charging session (as in the case where a utility demand reduces the available power).

Table 42 - EVSE maximum power limit

Element/Attribute Name	Type	Semantics
EVSEMaximumPowerLimit	complexType PhysicalValueType	Optional Element: Maximum power the EVSE can deliver.

4.2.44 EVSE Maximum Voltage Limit (EVSEMaximumVoltageLimit)

Source: SECC
Destination: EVCC

This signal represents the maximum voltage that can be maintained by the charger. The value may depend on coupler rating, ambient temperature, etc. The charger should regulate this value. The charger shall not exceed the minimum of this signal and the vehicle maximum voltage limit. This value can change dynamically through the charging session.

Table 43 - EVSE maximum voltage limit

Element/Attribute Name	Type	Semantics
EVSEMaximumVoltageLimit	complexType PhysicalValueType	Optional Element: Maximum voltage the EVSE can deliver.

4.2.45 EVSE Minimum Current Limit (EVSEMinimumCurrentLimit)

Source: SECC
Destination: EVCC

This signal represents the Minimum Current available from the charger to the vehicle. It informs the PEV that the DC supply can only regulate its current output down to this level. If a vehicle has RESS that must operate below this level, then the vehicle will determine that the charging station is incompatible. The vehicle will not start charging or will stop a charging session if the target RESS current falls below this value. The charger should regulate down to this value while still meeting the accuracy requirements. All chargers should be able to respond when the vehicle requests zero, that the output of the charger should be shut off to zero current.

Table 44 - EVSE minimum current limit

Element/Attribute Name	Type	Semantics
EVSEMinimumCurrentLimit	complexType PhysicalValueType	Minimum current the EVSE can deliver with the expected accuracy.

4.2.46 EVSE Minimum Voltage Limit (EVSEMinimumVoltageLimit)

Source: SECC
Destination: EVCC

This signal represents the minimum voltage available from the charger to the vehicle. It informs the PEV that the DC supply can only regulate its voltage output down to this level. If a vehicle has an RESS that must operate below this level, then the vehicle will determine that the charging station is incompatible. The vehicle will not start charging or will stop a charging session if the target RESS voltage falls below this value. The charger should regulate down to this value. The vehicle will decide if this is compatible with its RESS. A vehicle with an RESS below this value would not be compatible with the charger.

Table 45 - EVSE minimum voltage limit

Element/Attribute Name	Type	Semantics
EVSEMinimumVoltageLimit	complexType PhysicalValueType	Minimum voltage the EVSE can deliver with the expected accuracy.

4.2.47 EVSE Notification (EVSENotification)

Source: SECC
Destination: EVCC

Table 46 - EVSE notification

Element/Attribute Name	Type	Semantics
EVSENotification	simpleType EVSENotificationType enumeration	This value is used by the SECC to influence the behaviour of the EVCC. The EVSENotification contains an action that the SECC wants the EVCC to perform. The requested action is expected by the EVCC until the time provided in NotificationMaxDelay. If the target time is not in the future, the EVCC is expected to perform the action immediately. During normal operation, the value of EVSENotification is set to “None.”

[V2G-DC-500] For DC charging, the value of EVSENotification shall always be set to “None.”

4.2.48 EVSE Peak Current Ripple (EVSEPeakCurrentRipple)

Source: SECC
Destination: EVCC

This signal represents the DC supply's peak to peak ripple current amplitude of the regulated output at any current request. This signal informs the PEV what peak-to-peak magnitude of the DC supply current ripple can be expected at any charge level. This is dependent on the charger filter and control design. It is expected that quick chargers will have higher ripple, and may not be suitable for low current topoff charging (bulk level to full level). The vehicle may modify its charging strategy using this information. The vehicle may chose not to initiate the charging session if the value is not compatible with the RESS charging strategy. The vehicle may not support topoff charging if it cannot accept this amplitude of ripple current. The vehicle manufacturer can use this signal to optimize the charging algorithm.

Table 47 - EVSE peak current ripple

Element/Attribute Name	Type	Semantics
EVSEPeakCurrentRipple	complexType PhysicalValueType	Peak-to-peak magnitude of the current ripple of the EVSE.

4.2.49 EVSE Power Limit Achieved (EVSEPowerLimitAchieved)

Source: SECC
Destination: EVCC

This signal represents the charger is at the limit of its source capability (saturation). The charger becomes saturated when either the charger limits are achieved or the vehicle limits from handshaking have been achieved. It's used by the PEV control to compensate for reaching the limit. This would allow the vehicle to refrain from setting a fault when the charger is providing power to the limit of the present operating conditions.

Table 48 - EVSE power limit achieved

Element/Attribute Name	Type	Semantics
EVSEPowerLimitAchieved	simpleType boolean	If set to TRUE, the EVSE has reached its power limit.

4.2.50 EVSE Present Current (EVSEPresentCurrent)

Source: SECC
Destination: EVCC

This signal represents the measured high-voltage DC current at the output of the DC supply through the charge coupler.

Table 49 - EVSE present current

Element/Attribute Name	Type	Semantics
EVSEPresentCurrent	complexType PhysicalValueType	Present output current of the EVSE.

NOTE: The range allows for negative current measurements in the event that the energy is flowing out of the vehicle's charge receptacle.

4.2.51 EVSE Present Voltage (EVSEPresentVoltage)

Source: SECC
Destination: EVCC

This signal represents the measured high-voltage DC voltage at the output of the DC supply. It's used by the PEV during charging for diagnosis of on board sensors. It may be opportunistically used by the vehicle during charge as a redundant check to diagnose on-board sensors.

Table 50 - EVSE present voltage

Element/Attribute Name	Type	Semantics
EVSEPresentVoltage	complexType PhysicalValueType	Present voltage of EVSE.

4.2.52 EVSE Processing (EVSEProcessing)

Source: SECC
Destination: EVCC

Table 51 - EVSE processing

Element/Attribute Name	Type	Semantics
EVSEProcessing	simpleType: EVSEProcessingType enumeration	Parameter indicating that the EVSE has finished the processing that was initiated after the ContractAuthenticationReq or that the EVSE is still processing at the time the response message was sent.

NOTE: By using the EVSEProcessing parameter, the EVSE can indicate to the EVCC that the processing has not finished but a response message has to be sent to fulfill the timeout and performance requirements defined in 5.6.2. This allows a delay to the V2G communication session while fulfilling the performance and timeout requirements.

4.2.53 EVSE Status Code (EVSEStatusCode)

Source: SECC
Destination: EVCC

Table 52 - EVSE status code

Element/Attribute Name	Type	Semantics
EVSEStatusCode	simpleType: DC_EVSEStatusCodeType enumeration	Indicates the internal state of the EVSE.

This signal indicates the charger internal charging sequence state. That could be charger malfunction, utility interrupt event, charger ready, pre-charge, charger standby, etc.

In situations where a charger might have more than one state from the list below, the charger will determine the highest priority item to send to the vehicle for display.

This signal may contain any value defined by the enumerated type DC_EVSEStatusCodeType. The value and meaning of each enumeration is described in the table below.

[V2G-DC-347] The EVCC shall use the EVSEStatusCode in Table 53.

Table 53 - Semantics and type definition for EVSEStatusCodeType

Element Name	Semantics
EVSE_NotReady	Not authorized, StandBy, on maintenance, etc.
EVSE_Ready	Standard value used during normal operation.
EVSE_Shutdown	Charger shutdown, customer initiated shutdown.
EVSE_UtilityInterruptEvent	Utility interrupt event, utility or equipment operator has requested a temporary reduction in load.
EVSE_IsolationMonitoringActive	After the charging station has confirmed HV isolation internally, it will remain in this state until the cable isolation integrity is checked.
EVSE_EmergencyShutdown	Charging system incompatibility, emergency shutdown, or “E-stop” button pressed at charging station.
EVSE_Malfunction	A non-recoverable charger fault has occurred (isolation failure, etc.).
Reserved 8-C	Reserved by ISO/IEC for future use.

[V2G-DC-637] All EVSEStatusCodes in Table 53 for which there are no explicit requirements in this document are for information purpose only. They shall not influence the EV charging process.

[V2G-DC-638] EVSEStatusCode equal to "EVSE_Ready" shall be used unless a different value shall be used according to another requirement in this document.

NOTE: "EVSE_Shutdown" is used by the SECC to trigger a termination of the charging process in situations other than an emergency shutdown. "EVSE_EmergencyShutdown" may be used by the SECC to inform the EVCC that the EVSE is in the process of, or has just executed, an emergency shutdown. However, to force the EV to participate in the emergency shutdown, the SECC does not use this value, but instead uses the control pilot line (CPL) in accordance with SAE J1772. In all other cases, the expected value for EVSEStatusCode is "EVSE_Ready" or "EVSE_IsolationMonitoringActive."

4.2.54 EVSE Voltage Limit Achieved (EVSEVoltageLimitAchieved)

Source: SECC
Destination: EVCC

This signal indicates that the charger is at the limit of its source capability (saturation). The charger becomes saturated when either the charger limits are achieved or the vehicle limits from handshaking have been achieved. It's used by the PEV control to compensate for reaching the limit. This would allow vehicle to refrain from setting a fault when the charger is providing voltage to the limit of the present operating conditions.

Table 54 - EVSE voltage limit achieved

Element/Attribute Name	Type	Semantics
EVSEVoltageLimitAchieved	simpleType boolean	If set to TRUE, the EVSE has reached its voltage limit.

4.2.55 External Payment (ExternalPayment)

Source: EVCC
Destination: SECC

Not used for DC charging. See 4.2.85.

4.2.56 Free Service (FreeService)

Source: SECC
Destination: EVCC

Table 55 - External payment

Element/Attribute Name	Type	Semantics
FreeService	simpleType: boolean	This element is used by the SECC to indicate if a service can be used by the EVCC free of charge or not. If FreeService is equal to true, the EV can use the offered service without payment. If FreeService is equal to false the service, if used by the EV, will be billed using the payment method negotiated using the payment option message element.

4.2.57 Full SOC (FullSOC)

Source: EVCC
Destination: SECC

This signal defines the SOC where the vehicle considers the RESS is full. It is defined by each vehicle OEM and allows the charger to display the full charge status.

Table 56 - Full SOC

Element/Attribute Name	Type	Semantics
FullSOC	simpleType: percentValueType byte (range: 0-100)	Optional Element: SOC at which the EV considers the battery to be fully charged.

4.2.58 General Challenge (GeneralChallenge)

Source: EVCC
Destination: SECC

Table 57 - General challenge

Element/Attribute Name	Type	Semantics
GenChallenge	simpleType genChallengeType string	Optional Element: This optional element shall not be used.

Not used for DC charging.

4.2.59 ID (Identification)

Source: EVCC
Destination: SECC

Table 58 - ID

Element/Attribute Name	Type	Semantics
Id	simpleType IDREF	Optional Element. this optional element shall not be used.

Not used for DC charging.

4.2.60 Multiplier (Multiplier)

Source: SECC
Destination: EVCC

Table 59 - Multiplier

Element/Attribute Name	Type	Semantics
Multiplier	simpleType: unitMultiplierType byte (range: -3..+3)	The Multiplier defines the exponent to base 10 (dec). The final physical value is determined by: Value * 10 ^ Multiplier [Unit].

See 4.2.69.

4.2.61 Notification Max Delay (NotificationMaxDelay)

Source: SECC
Destination: EVCC

Table 60 - Notification max delay

Element/Attribute Name	Type	Semantics
NotificationMaxDelay	simpleType unsignedInt	The SECC uses the NotificationMaxDelay element in the EVSEStatus to indicate the time until it expects the EVCC to react on the action request indicated in EVSENotification. If the target time is not in the future, the EVCC is expected to perform the action immediately.

[V2G-DC-636] For DC charging the EVCC shall ignore the value of the parameter NotificationMaxDelay in the EVSEStatus.

4.2.62 P Max (PMax)

Source: SECC
Destination: EVCC

Table 61 - P max

Element/Attribute Name	Type	Semantics
PMax	simpleType: PMaxType short	Defines maximum amount of power to be drawn from the EVSE outlet the vehicle is connected to.

[V2G-DC-333] The PMax element shall define the maximum amount of power to be drawn from the EVSE outlet when the element of type PMaxScheduleEntryType is active.

4.2.63 P Max Schedule (PMaxSchedule)

Source: SECC
Destination: EVCC

[V2G-DC-324] The SECC shall provide a PMaxSchedule element based upon the limits of the local installation if no secondary actor provides a grid schedule.

[V2G-DC-559] Since for DC charging, the EVCC is not able to provide a planned departure time, SAScheduleList shall provide PMaxSchedule covering at least 24 hours.

[V2G-DC-326] The SECC and the EVCC shall implement this type as defined in Figure 9.

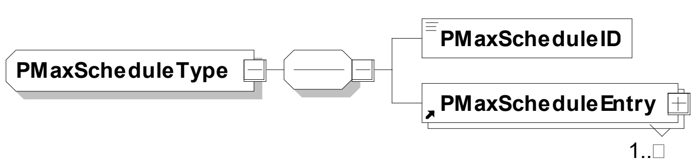


Figure 9 - Schema diagram—PMaxScheduleType

4.2.64 P Max Schedule Entry (PMaxScheduleEntry)

Source: SECC
Destination: EVCC

Table 62 - P max schedule entry

Element/Attribute Name	Type	Semantics
PMaxScheduleEntry	complexType: PMaxScheduleEntryType	List of PMaxScheduleEntry elements

[V2G-DC-329] The number of PMaxScheduleEntry elements in the PMaxScheduleType shall be limited to twelve.

4.2.65 P Max Schedule Entry Type (PMaxScheduleEntryType)

Source: SECC
Destination: EVCC

[V2G-DC-330] The SECC and the EVCC shall implement this type as defined in Figure 10.

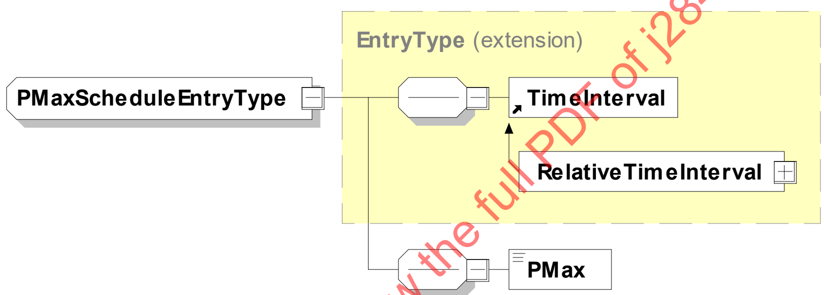


Figure 10 - Schema diagram—PMaxScheduleEntryType

[V2G-DC-331] The message element shall be used as defined in RelativeTimeInterval and PMax.

4.2.66 P Max Schedule ID (PMaxScheduleID)

Source: SECC
Destination: EVCC

Table 63 - P max schedule ID

Element/Attribute Name	Type	Semantics
PMaxScheduleID	simpleType: SAIDType short	Unique identifier for an element of type PMaxScheduleType across a charging session.

[V2G-DC-328] The value of the PMaxScheduleID element shall uniquely identify an element of type PMaxScheduleType during the entire charging session.

4.2.67 Parameter Set ID (ParameterSetID)

Source: EVCC
Destination: SECC

Table 64 - Parameter set ID

Element/Attribute Name	Type	Semantics
ParameterSetID	--	Optional Element: NOTE: This optional element shall not be used.

[V2G-DC-555] The element “ParameterSetID” shall not be used for DC charging.

4.2.68 Payment Options (PaymentOptions)

Source: SECC
Destination: EVCC

This signal includes the list of payment options an EVSE offers to the vehicle indicating what method could be chosen to pay for the services. The vehicle can only select one payment method for all services used.

NOTE: Only the payment option “external payment” shall be used, since detailed payment options are not yet defined.

Table 65 - Payment options

Element/Attribute Name	Type	Semantics
PaymentOptions	complexType: paymentOptionsType	Not used with DC charging. Indicates that external payment methods are being used to enable the charge process. This element includes the list of payment options an SECC offers to the EVCC indicating what method could be chosen to pay for the services. The EVCC can only select one payment method for all services used by the EVCC.

[V2G-DC-301] The EVCC and the SECC shall implement this type as defined in Figure 11.

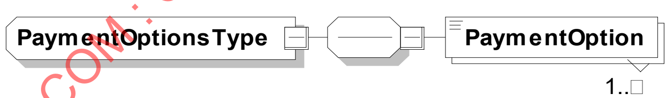


Figure 11 - Schema diagram—PaymentOptionsType

[V2G-DC-633] Only the PaymentOption “ExternalPayment” shall be used.

[V2G-DC-634] The number of PaymentOption elements in the PaymentOptionsType shall be limited to 2.

4.2.69 Physical Value Type (PhysicalValueType)

Source: SECC
Destination: EVCC

[V2G-DC-297] The SECC and the EVCC shall implement this type as defined in Figure 12.

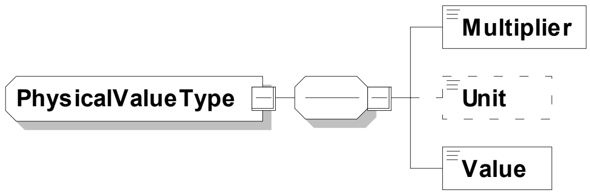


Figure 12 - Schema diagram—PhysicalValueType

[V2G-DC-298] The message element shall be used as defined in Table 66.

Table 66 - Semantics and type definition for PhysicalValueType

Element Name	Type	Semantics
Multiplier	simpleType: unitMultiplierType byte (range: -3..+3)	The Multiplier defines the exponent to base 10 (dec). The final physical value is determined by: Value * 10 ^ Multiplier [Unit].
Unit	simpleType: unitSymbolType enumeration	Optional Element: Unit of the value.
Value	simpleType short	Value which has to be multiplied.

4.2.70 Priority (Priority)

Source: EVCC
Destination: SECC

This signal is used by the vehicle for indicating the protocol priority of a specific protocol allowing the EVSE to select a protocol based on priorities.

Table 67 - Priority

Element/Attribute Name	Type	Semantics
Priority	simpleType: priorityType unsignedByte (range 1..20)	This message element is used by the EVCC for indicating the protocol priority of a specific protocol allowing the SECC to select a protocol based on priorities.

4.2.71 Profile Entry (ProfileEntry)

Source: EVCC
Destination: SECC

Table 68 - Profile entry

Element/Attribute Name	Type	Semantics
ProfileEntry	complexType: ProfileEntryType	Element used for encapsulating an individual charging profile entry of the charge schedule

4.2.72 Profile Entry Type (ProfileEntryType)

Source: SECC
Destination: EVCC

[V2G-DC-307] The number of ProfileEntry elements in the ChargingProfileType shall be limited to 24.

[V2G-DC-308] The SECC and the EVCC shall implement this type as defined in Figure 13.

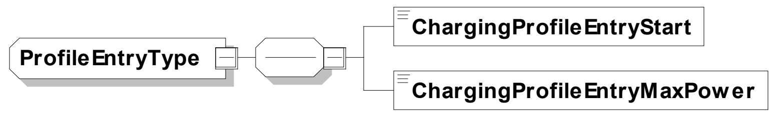


Figure 13 - Schema diagram—ProfileEntryType

4.2.73 Protocol Namespace (ProtocolNamespace)

Source: EVCC
Destination: SECC

This signal is used by the vehicle to uniquely identify the Namespace URI of a specific protocol supported by the vehicle; i.e., this is the protocol name of the related protocol.

Table 69 - Protocol namespace

Element/Attribute Name	Type	Semantics
ProtocolNamespace	simpleType: protocolNamespaceType string (max length: 100)	This message element is used by the EVCC to uniquely identify the Namespace URI of a specific protocol supported by the EVCC; i.e., this is the protocol name of the related protocol.

4.2.74 Ready to Charge State (ReadyToChargeState)

Source: EVCC
Destination:SECC

This signal tells the EVSE that the vehicle is ready for full energy transfer (i.e., any contactors are closed and Pre-charge is complete) and the EVSE can enable its full high voltage output regulation. Any circuits related to inrush current limiting and HV bus pre-charging can be disabled in the EVSE to allow regulated control of the output power. This commands the DC supply to switch on the high-power conversion circuit.

During shutdown, this signal tells the EVSE that the vehicle has completed charging, and that the EVSE should discharge the HV output bus.

4.2.75 Relative Time Interval (RelativeTimeInterval)

Source: SECC
Destination: EVCC

Table 70 - Relative Time Interval

Element/Attribute Name	Type	Semantics
RelativeTimeInterval	complexType: RelativeTimeInterval substitutes abstract element TimeInterval.	Extends the TimeIntervalType and defines the time interval the PMaxScheduleEntry is valid for based upon relative times.

[V2G-DC-332] Any extension of the TimeInterval element shall define the active period of time for the respective parent element of type PMaxScheduleEntryType.

[V2G-DC-334] The SECC and the EVCC shall implement this type as defined in Figure 14.

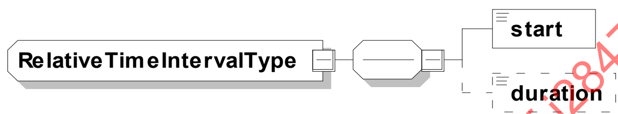


Figure 14 - Schema diagram—RelativeTimeIntervalType

4.2.76 Remaining Time to Bulk SOC (RemainingTimetoBulkSOC)

Source: EVCC
Destination: SECC

This signal from the vehicle allows the charging station to display a time remaining count. This value is the Remaining time to charge PEV up to the bulk SOC. The time represents how much time it will take to get from the actual SOC to the bulk SOC. The DC supply may optionally use this periodic signal from the vehicle in order to display information to the user. The DC supply will not stop the charging session based on this time; the vehicle always controls the charging session stop time. OEM will decide bulk level (80% for example).

Table 71 - Remaining time to bulk SOC

Element/Attribute Name	Type	Semantics
RemainingTimeToBulkSOC	complexType PhysicalValueType	Optional Element: Estimated or calculated time until bulk charge (approximately 80% SOC) is complete.

4.2.77 Remaining Time to Full SOC (RemainingTimetoFullSOC)

Source: EVCC
Destination: SECC

This signal represents remaining time to charge PEV to full SOC; that is, the interval in time when no more energy is needed to charge the RESS. Display time to charge from actual SOC to full SOC. The DC supply may optionally use this periodic signal from the vehicle in order to display information to the user. The DC supply will not stop the charging session based on this time; the vehicle always controls the charging session stop time.

Table 72 - Remaining time to full SOC

Element/Attribute Name	Type	Semantics
RemainingTimeToFullSOC	complexType PhysicalValueType	Optional Element: Estimated or calculated time until full charge (100% SOC) is complete.

4.2.78 Response Code (ResponseCode)

Source: SECC
Destination: EVCC

This response code is included in all response messages except session setup (see below).

Table 73 - Response code

Element Name	Type	Semantics
ResponseCode	simpleType: responseCodeType enumeration	Response Code indicating the acknowledgment status of any of the V2G messages received by the SECC. This message element is used by the SECC for indicating whether the list of protocols received from the EVCC includes at least one protocol matching with the protocols supported by the SECC. Signals a response code with the following meaning: - OK_SuccessfulNegotiation: successful negotiation of a application protocol. - OK_SuccessfulNegotiationWithMinorDeviation: successful negotiation of a protocol, with minor deviation. - Failed_NoNegotiation: failed negotiation of protocols.

This enumerated state encoded signal indicates how the charge station has responded to a specific request message from the vehicle. Depending on the value in the response code the vehicle decides if it can proceed with the charge process or if it has to handle an error. This signal may contain any value defined by the enumerated type responseCodeType. The value and meaning of each enumeration is described in the table below.

Any value starting with "FAILED" indicates an negative response. Detailed information may be provided by FAILED_<additional info>. This information may be used to differentiate the reaction on the negative response.

Any value starting with "OK" indicates a positive response. Detailed information may be provided by OK_<additional info>. This information may be used to differentiate the reaction on the positive response.

Table 74 - Response code values

XML Response Code Enumeration	Comments/Description
OK	Indicates if the processing of the request message was successful and no specific ResponseCodeType is defined for the current state.
OK_NewSessionEstablished	Indicates processing of the SessionSetupReq message was successful and a different SessionID is contained in the response message than the SessionID in the request message.
OK_OldSessionJoined	Indicates processing of the SessionSetupReq message was successful and the same SessionID as used in the request message is contained in the response message.
OK_CertificateExpiresSoon	Not used for DC charging.
FAILED	Indicates the processing of the request message was not successful and no specific "responseCodeType" is defined for the current error case.
FAILED_SequenceError	Indicates the EVSE has received an unexpected request message.
FAILED_ServiceIDInvalid	Not used for DC charging.
FAILED_UnknownSession	Indicates the SessionID in the request message does not fit to the EVSE provided SessionID during SessionSetupRes.
FAILED_ServiceSelectionInvalid	Indicates the SelectedServiceList contained in the ServicePaymentSelectionReq message contains a ServiceID which was not contained in the offered ServiceList of ServiceDiscoveryRes.
FAILED_PaymentSelectionInvalid	Indicates the SelectedPaymentOption contained in the ServicePaymentSelectionReq message was not part of the offered PaymentOptions of ServiceDiscoveryRes.
FAILED_CertificateExpired	Not used for DC charging.
FAILED_SignatureError	Indicates the validation of the Security element in the message header failed.
FAILED_NoCertificateAvailable	Not used for DC charging.
FAILED_CertChainError	Not used for DC charging.
FAILED_ChallengeInvalid	Not used for DC charging.
FAILED_ContractCanceled	Not used for DC charging.
FAILED_WrongChargeParameter	Indicates if the contents of ChargeParameterDiscoveryReq message is not valid, e.g., wrong parameter set is provided, one or multiple parameters cannot be interpreted.
FAILED_PowerDeliveryNotApplied	Indicates the EVSE is not able to deliver energy
FAILED_TariffSelectionInvalid	Indicates the charging profile in the PowerDeliveryReq message contains a SAtupleID which was not contained in the "SASchedules" attribute provided in "ChargeParameterDiscoveryRes."
FAILED_ChargingProfileInvalid	Indicates the charging profile in the PowerDeliveryReq message violates a power limitation provided in "ChargeParameterDiscoveryRes."
FAILED_EVSEPresentVoltageToLow	Not used for DC charging.
FAILED_MeteringSignatureNotValid	Not used for DC charging.
FAILED_WrongEnergyTransferType	The vehicle requested energy transfer does not match what the DC supply is able to deliver.

4.2.79 SA Schedule List (SAScheduleList)

Source: SECC
Destination: EVCC

Table 75 - SA schedule list

Element/Attribute Name	Type	Semantics
SAScheduleList	complexType: SAScheduleListType substitutes abstract type SASchedulesType	Includes several tuples of schedules from secondary actors.

[V2G-DC-559] Since for DC charging, the EVCC is not able to provide a planned departure time, SAScheduleList shall provide PMaxSchedule covering at least 24 hours.

4.2.80 SA Schedule List Type (SA ScheduleListType)

Source: SECC
Destination: EVCC

[V2G-DC-315] The SECC and the EVCC shall implement this type as defined in Figure 15.

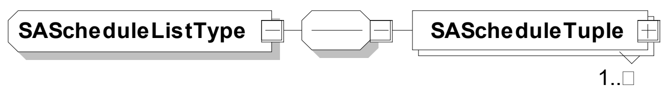


Figure 15 - Schema diagram—SAScheduleListType

4.2.81 SA Schedule Tuple (SAScheduleTuple)

Source: SECC
Destination: EVCC

This signal represents an optional element: includes several types of schedules from secondary actors.

Table 76 - SA schedule tuple

Element/Attribute Name	Type	Semantics
SAScheduleTuple	complexType: SAScheduleTupleType	Includes several tuples of schedules from secondary actors.

[V2G-DC-317] The number of SAScheduleTuple elements in the SAScheduleListType shall be limited to three.

[V2G-DC-318] The EVCC may implement a mechanism to compare different SAScheduleTuple elements in order to optimize the charge schedule considering any given kind of cost.

[V2G-DC-319] The first SAScheduleTuple element in the SAScheduleListType shall be defined as default SASchedule.

[V2G-DC-320] If the EVCC is not capable of comparing different SAScheduleTuple elements or comparison fails, the EVCC shall choose the default SAScheduleTuple according to [V2G-DC-319].

4.2.82 SA Schedule Tuple ID (SAScheduleTupleID)

Source: SECC
Destination: EVCC

and:

Source: EVCC
Destination: SECC

Table 77 - SA schedule tuple ID

Element/Attribute Name	Type	Semantics
SAScheduleTupleID	simpleType: SAIDType short	Unique identifier within a charging session referring to the selected SAScheduleTuple element from the SAScheduleListType.

[V2G-DC-305] The value of the SAScheduleTupleID element shall be equal to one of the values of the SAScheduleTupleID elements in the list of SAScheduleTuple elements provided with the charge parameter discovery response message (see 6.4.1.6.3).

[V2G-DC-306] The SAScheduleTupleID element shall identify the selected SAScheduleTuple element in the list of SAScheduleTuple elements provided in the charge parameter discovery response message (see 6.4.1.6.3).

[V2G-DC-323] The SAScheduleTupleID element shall be unique within all SAScheduleTuple elements in the SAScheduleListType and uniquely identifies a tuple of PMaxSchedule and SalesTariff (this optional element is not used here) elements during the entire charging session.

4.2.83 SA Schedule Tuple Type (SAScheduleTupleType)

Source: SECC
Destination: EVCC

[V2G-DC-321] The SECC and the EVCC shall implement this type as defined in Figure 16.

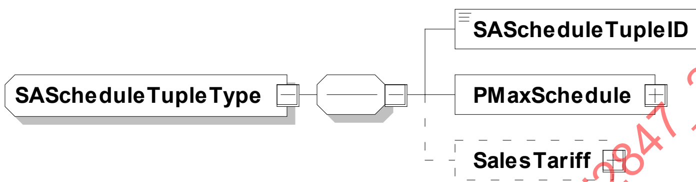


Figure 16 - Schema diagram—SAScheduleTupleType

[V2G-DC-554] The element “SalesTariff” shall not be used.

4.2.84 Schema ID (SchemaID)

Source: EVCC
Destination: SECC

This signal is used by the vehicle to indicate the schema ID assigned by the vehicle to the protocol indicated in the signals ProtocolNamespace, VersionNumberMajor and VersionNumberMinor. This message element is used by the EVSE to reference one of the vehicle supported protocols received in the request message. This identifier also allows for referring to a particular protocol later on in the communication process (this signal will be used in lieu of the EXI header option schemaID).

The response is also a signal in the supportedAppProtocolRes message from the SECC to the EVCC.

Source: SECC
Destination: EVCC

Table 78 - Schema ID

Element/Attribute Name	Type	Semantics
SchemaID	simpleType: unsignedByte	This message element is used by the EVCC to indicate the schemaID assigned by the EVCC to the protocol indicated in the message element ProtocolNamespace, VersionNumberMajor and VersionNumberMinor. This message element is used by the SECC to reference one of the EVCC supported protocols received in the request message. This identifier allows also for referring to a particular protocol later on in the communication process (EXI Option schemaID).

4.2.85 Selected Payment Option (SelectedPaymentOption)

Source: EVCC
Destination: SECC

This enumerated state signal is used for indicating the payment type selected for the use of all selected services in the selectedServiceList.

Table 79 - Selected payment option

XML Response Code Enumeration	Comments/Description
Contract	Not used with DC charging
ExternalPayment	Indicates that external payment methods are being used to enable the charge process.

NOTE: Only the payment option External Payment shall be used, since detailed payment options are not yet defined.

Table 80 - Selected payment option used

Element/Attribute Name	Type	Semantics
SelectedPaymentOption	complexType: PaymentOptionType	This element is used for indicating the payment type selected for the use of all selected services in the selectedServiceList.

4.2.86 Selected Service (SelectedService)

Source: EVCC
Destination: SECC

Table 81 - Selected service

Element/Attribute Name	Type	Semantics
SelectedService	complexType: SelectedServiceType	This element is used to indicate the selected ServiceID and the associated parameterSet.

Not used for DC charging.

4.2.87 Selected Service List (SelectedServiceList)

Source: EVCC
Destination:SECC

Table 82 - Selected service list

Element/Attribute Name	Type	Semantics
SelectedServiceList	complexType: SelectedServiceListType	List contains all selected ServiceIDs and the optional parameterSetID for applicable for the respective serviceID.

4.2.88 Selected Service List Type (SelectedServiceListType)

Source: EVCC
Destination: SECC

[V2G-DC-340] The EVCC and the SECC shall implement this type as defined in Figure 17.

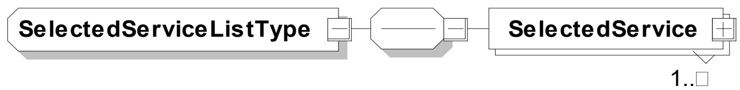


Figure 17 - Schema diagram—SelectedServiceListType

[V2G-DC-341] The message element shall be used is in Table 83.

Table 83 - Semantics and type definition for SelectedServiceListType

Element Name	Type	Semantics
SelectedService	complexType: SelectedServiceType	This element is used to indicate the selected ServiceID and the associated parameterSet.

[V2G-DC-635] The number of SelectedService elements in the SelectedServiceListType shall be limited to one.

Not used for DC charging.

4.2.89 Selected Service Type (SelectedServiceType)

Source: EVCC
Destination: SECC

[V2G-DC-342] The EVCC and the SECC shall implement this type as defined in Figure 18.

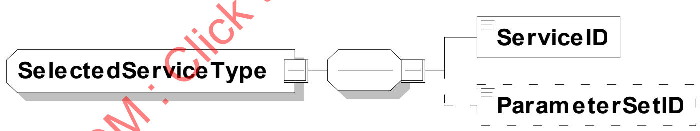


Figure 18 - Schema diagram—SelectedServiceType

[V2G-DC-343] The message element shall be used is in Table 84.

Table 84 - Semantics and type definition for SelectedServiceType

Element Name	Type	Semantics
ServiceID	simpleType: unsignedShort	Unique identifier of the service
ParameterSetID	--	Optional Element: NOTE: This optional element shall not be used.

[V2G-DC-555] The element "ParameterSetID" shall not be used.

4.2.90 Service Category (ServiceCategory)

Source: EVCC
Destination:SECC

then:

Source: SECC
Destination: EVCC

Table 85 - Service category

Element/Attribute Name	Type	Semantics
ServiceCategory	simpleType: serviceCategoryType enumeration	Optional Element: Defines the service category for the Service Discovery (e.g., EV charging, internet access, etc.). By applying a category to the Service Discovery the resulting list of services returned in the ServiceDiscoveryRes can be limited to a certain category of services, thus enabling pre-filtering. The SECC always returns all supported services for all categories if no specific category has been indicated in request message by using the ServiceCategory message element. NOTE: If this optional element is used, it shall always contain the value “EVcharging.”

[V2G-DC-557] If the optional element ServiceCategory is used, it shall always contain the value “EVcharging.”

4.2.91 Service Charge Type (ServiceChargeType)

Source: SECC
Destination: EVCC

EV charging specific service derived from ServiceType which contains additional information about EVSESSupportedEngeryTransferType(s) offered by the EVSE.

[V2G-DC-294] The SECC and the EVCC shall implement this type as defined in Figure 19.

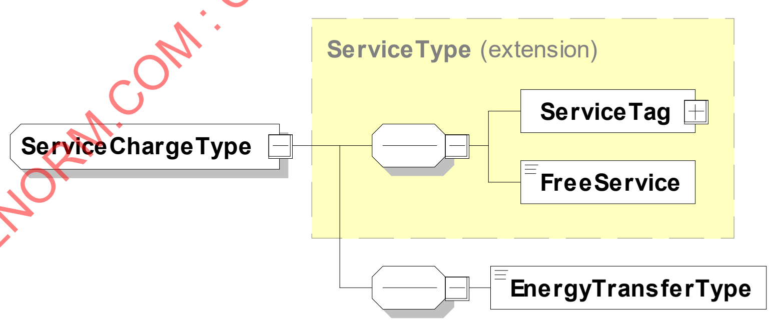


Figure 19 - Schema diagram—ServiceChargeType

Table 86 - Service charge type

Element/Attribute Name	Type	Semantics
ChargeService	complexType: ServiceChargeType	Available charging services supported by the EVSE.

4.2.92 Service ID (ServiceID)

Source: SECC
Destination: EVCC

and:

Source: EVCC
Destination: SECC

Table 87 - Service ID

Element/Attribute Name	Type	Semantics
ServiceID	simpleType: unsignedShort	Unique identifier of the service.

Not used for DC charging.

4.2.93 Service List (ServiceList)

Source: SECC
Destination: EVCC

See Service Type.

Table 88 - Service list

Element/Attribute Name	Type	Semantics
ServiceList	--	Optional Element: NOTE: This optional element shall not be used.

[V2G-DC-549] The element “ServiceList” shall not be used.

4.2.94 Service Name (ServiceName)

Source: SECC
Destination: EVCC

Table 89 - Service name

Element/Attribute Name	Type	Semantics
ServiceName	simpleType: serviceNameType string (max length: 32)	Optional Element: Human readable service name.

[V2G-DC-628] The optional element “ServiceName” shall not be used.

4.2.95 Service Payment Selection Req Type (ServicePaymentSelectionReqType)

Source: EVCC
Destination: SECC

See Service Payment Selection Req.

4.2.96 Service Scope (ServiceScope)

Source: EVCC
Destination:SECC

and:

Source: SECC
Destination: EVCC

Table 90 - Service scope

Element/Attribute Name	Type	Semantics
ServiceScope	simpleType: serviceScopeType string (max length: 32)	Optional Element: Defines the scope of the Service Discovery. A scope is defined by a unique URI which corresponds to a service provider (e.g., mobility provider, value added service provider, etc.). The Service Discovery can respect multiple scopes in one request. By applying a scope to the service discovery the resulting list of services returned in the ServiceDiscoveryRes can be limited to a certain scope, thus enables pre-filtering. The SECC always returns all supported services for all scopes if no specific ServiceScope has been indicated in request message.

[V2G-DC-629] The optional element “ServiceScope” shall not be used.

4.2.97 Service Tag (ServiceTag)

Source: SECC
Destination: EVCC

This includes the data elements to uniquely identify a service. See 4.2.98 for additional signal details.

Table 91 - Service tag

Element/Attribute Name	Type	Semantics
ServiceTag	complexType: serviceTagType	Includs the data elements to uniquely identify a service.

4.2.98 Service Tag Type (ServiceTagType)

Source: SECC
Destination: EVCC

This type represents a tag for a specific service. It gives a short definition and identification of a specific service.

[V2G-DC-290] The SECC and the EVCC shall implement this type as defined in Figure 20.

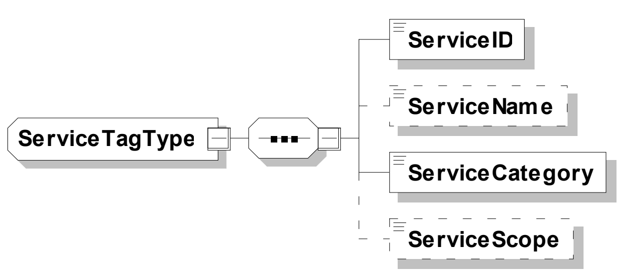


Figure 20 - Schema diagram—ServiceTagType

4.2.99 Service Type (ServiceType)

Source: SECC
Destination: EVCC

[V2G-DC-292] The SECC and the EVCC shall implement this type as defined in Figure 21.

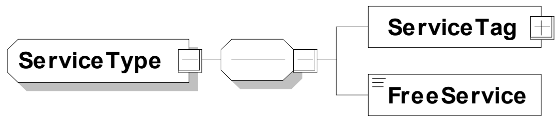


Figure 21 - Schema diagram—ServiceType

4.2.100 Session Setup Code (ResponseCode)

Source: SECC
Destination: EVCC

This enumerated state encoded signal indicates how the charge station has responded to the session setupReq message from the vehicle.

Table 92 - Session setup code

XML Response Code Enumeration	Comments/Description
OK_SuccessfulNegotiation	Successful negotiation of an application protocol.
OK_SuccessfulNegotiationWithMinorDeviation	Successful negotiation of a protocol, with minor deviation.
Failed_NoNegotiation	Failed negotiation of protocols.

4.2.101 Start (Start)

Source: SECC
Destination: EVCC

Table 93 - Start

Element/Attribute Name	Type	Semantics
start	simpleType unsignedInt	Start of the interval, in seconds from NOW.

[V2G-DC-336] The value of the start element shall be defined in seconds from NOW.

[V2G-DC-337] The value of the start element shall simultaneously define the start time of this interval and the stop time of the previous interval.

4.2.102 Unit (Unit)

Source: SECC
Destination: EVCC

Table 94 - Unit

Element/Attribute Name	Type	Semantics
Unit	simpleType: unitSymbolType enumeration	Optional Element: Unit of the value

See 4.2.69.

4.2.103 Value (Value)

Source: SECC
Destination: EVCC

Table 95 - Value

Element/Attribute Name	Type	Semantics
Value	simpleType short	Value which has to be multiplied

See 4.2.69.

4.2.104 Version Number Major (VersionNumberMajor)

Source: EVCC
Destination: SECC

This signal is used by the vehicle to indicate the major version number of the protocol indicated in the message element ProtocolNamespace.

This is sent at the beginning of the charging session in order to coordinate which signals can be used. This signal was included to support the existence of future protocols It is expected that if a new protocol is developed, that devices will fall back to support the lower level protocol.

Table 96 - Version number major

Element/Attribute Name	Type	Semantics
VersionNumberMajor	simpleType unsignedInt	This message element is used by the EVCC to indicate the major version number of the protocol indicated in the message element ProtocolNamespace.

4.2.105 Version Number Minor (VersionNumberMinor)

Source: EVCC
Destination: SECC

This signal is used by the vehicle to indicate the minor version number of the protocol indicated in the message element ProtocolNamespace.

Minor version changes shall be backward compatible, as long as the major version number has not changed.

Table 97 - Version number minor

Element/Attribute Name	Type	Semantics
VersionNumberMinor	simpleType unsignedInt	This message element is used by the EVCC to indicate the minor version number of the protocol indicated in the message element ProtocolNamespace.

5. MESSAGES

5.1 Message Summary

5.1.1 Supported Application Protocol Request (SupportedAppProtocolReq)

Before starting the application layer message exchange, an appropriate application layer protocol including its version shall be negotiated between the EVCC and the SECC.

This is further defined in Section 6.

5.1.2 Supported Application Protocol Response (SupportedAppProtocolRes)

Before starting the application layer message exchange, an appropriate application layer protocol including its version shall be negotiated between the EVCC and the SECC.

5.1.3 Session Setup Request (SessionSetupReq)

By using the SessionSetupReq message, the EVCC establishes a V2G communication session.

5.1.4 Session Setup Response (SessionSetupRes)

By using the SessionSetupRes message the SECC responds to an SessionSetupReq. With the SessionSetupRes message, the SECC notifies the EVCC with an enclosed response code, whether establishing a new session or joining a previous session was successful or not.

5.1.5 Service Discovery Request (ServiceDiscoveryReq)

By sending the ServiceDiscoveryReq message, the EVCC triggers the SECC to send information about all services offered by the SECC. Furthermore, the EVCC can limit for particular services by using the service scope and service type elements.

5.1.6 Service Discovery Response (ServiceDiscoveryRes)

After receiving the ServiceDisoveryReq message of the EVCC, the SECC sends the ServiceDiscoveryRes message. In case of a successful service discovery, the response lists all available services of the SECC for the defined criteria. In case the service discovery failed, the service list is empty and the response code indicates potential reasons.

5.1.7 Service and Payment Selection Request (ServicePaymentSelectionReq)

This ServicePaymentSelectionReq message transports the information on the selected services and on how the all the selected services are paid.

5.1.8 Service and Payment Selection Response (ServicePaymentSelectionRes)

With this ServicePaymentSelectionRes message, the SECC informs the EVCC whether the selected services and payment option were accepted.

5.1.9 Contract Authentication Request (ContractAuthenticationReq)

By sending the ContractAuthenticationReq message to the SECC, the EVCC provides the contract certificate to SECC to identify a private key which is used for tarrif table signature. This message is optional.

5.1.10 Contract Authentication Response (ContractAuthenticationRes)

After receiving the ContractAuthenticationReq message from the EVCC, the SECC sends the ContractAuthenticationRes message as an acknowledgement status and EVSE status to the EVCC.

5.1.11 Charge Parameter Discovery Request (ChargeParameterDiscoveryReq)

By sending the ChargeParameterDiscoveryReq message, the EVCC provides its charging parameters to the SECC. This message provides status information about the PEV and additional charging parameters, like estimated energy amounts for recharge and the point in time for the end of charge.

5.1.12 Charge Parameter Discovery Response (ChargeParameterDiscoveryRes)

With the ChargeParameterDiscoveryRes message, the SECC provides applicable charge parameters from the grid's perspective. Next to general charge parameters of the EVSE this optionally includes further information on cost over time, cost over demand, cost over consumption, or a combination of these. The term "cost" refers to any kind of cost specified in this version of the standard and is not limited to monetary costs. Based on this cost information, the PEV may optimize its charge for the requested amount of energy.

5.1.13 Power Delivery Request (PowerDeliveryReq)

By sending the PowerDeliveryReq message, the EVCC requests the EVSE to switch power on and transmits the charging profile it will follow during the charging process.

5.1.14 Power Delivery Response (PowerDeliveryRes)

After receiving the PowerDeliveryReq message of the EVCC, the SECC sends the PowerDeliveryRes message including information if power will be available.

5.1.15 Cable Check Request (CableCheckReq)

With the CableCheckReq message, the PEV asks the EVSE to perform a cable check, which includes an isolation test, before charging.

5.1.16 Cable Check Response (CableCheckRes)

After receiving the CableCheckReq message of the PEV, the EVSE sends the CableCheckRes message informing the PEV about result of its cable check and EVSE status.

5.1.17 Pre Charging Request (PreChargeReq)

With the PreChargeReq message, the EVCC asks the EVSE to apply certain values for output voltage and output current. Since the contactors of the PEV are open during Pre-Charging, the actual current flow from the EVSE to the PEV will be very small; i.e., in most cases, smaller than the requested output current. The EVCC/SECC may use several pre-charging request/response message pairs in order to precisely adjust the EVSE output voltage to the PEV RESS voltage measured inside the PEV.

5.1.18 Pre Charging Response (PreChargeRes)

After receiving the PreChargeReq message of the EVCC, the EVSE sends the PreChargeRes message informing the PEV about EVSE status and present EVSE output voltage.

5.1.19 Current Demand Request (CurrentDemandReq)

By sending the CurrentDemandReq message, the PEV requests a certain current from EVSE. Also the target voltage and current are transferred.

5.1.20 Current Demand Response (CurrentDemandRes)

After receiving the CurrentDemandReq message from the EVCC, the SECC sends the CurrentDemandRes message informing the PEV about EVSE status and present EVSE output voltage and current.

5.1.21 Welding Detection Request (WeldingDetectionReq)

The EVCC sends the WeldingDetectionReq message to obtain from the EVSE the voltage value measured by the EVSE at its output.

5.1.22 Welding Detection Response (WeldingDetectionRes)

After receiving the WeldingDetectionReq message from the EVCC, the EVSE sends the WeldingDetectionRes informing the PEV about the EVSE status and the present EVSE output voltage.

5.1.23 Session Stop Request (SessionStopReq)

By sending the SessionStopReq message, the EVCC requests termination of the charging process.

5.1.24 Session Stop Response (SessionStopRes)

After receiving the SessionStopReq message from the EVCC, the SECC sends the SessionStopRes message informing the EVCC if terminating the charging process was successful.

5.2 Message List Table

The message ID's in the table shown below directly align with the request/response messages identified in the sequence diagrams in Figures A1 through A4. See the XML schema in Appendix E.

Table 98 - Message list table

Msg ID	XML Message Name	Corresponding XML Message Elements
0a	supportedAppProtocolReq	**AppProtocol** ProtocolNamespace VersionNumberMajor VersionNumberMinor SchemaID Priority
0b	supportedAppProtocolRes	ResponseCode SchemaID
1a	SessionSetupReq	EVCCID (PEV ID)
1b	SessionSetupRes	ResponseCode EVSEID DateTimeNow
2a	ServiceDiscoveryReq	ServiceScope ServiceCategory

Msg ID	XML Message Name	Corresponding XML Message Elements
2b	ServiceDiscoveryRes	ResponseCode **PaymentOptions** PaymentOption **ChargeService** **ServiceTag** ServiceID ServiceName ServiceCategory ServiceScope FreeService EnergyTransferType **ServiceList** **Service** ServiceTag ServiceID ServiceName ServiceCategory ServiceScope FreeService
Xa	ServicePaymentSelectionReq	ServicePaymentSelectionReqType SelectedPaymentOption Contract ExternalPayment SelectedServiceList ServiceID ParameterSetID
Xb	ServicePaymentSelectionRes	ResponseCode
Ya	ContractAuthenticationReq	GenChallenge Id
Yb	ContractAuthenticationRes	ResponseCode EVSEProcessing

Msg ID	XML Message Name	Corresponding XML Message Elements

3a	ChargeParameterDiscoveryReq	EVRequestedEnergyTransferType
		DC_EVChargeParameter
		    DC_EVStatus
		        EVReady
		        EVCabinConditioning
		        EVRESSConditioning
		        EVErrorCode
		        EVRESSSOC
		    EVMaximumCurrentLimit
		    EVMaximumPowerLimit
		    EVMaximumVoltageLimit
		    EVEnergyCapacity
		    EVEnergyRequest
		    FullSOC
		    BulkSOC

Msg ID	XML Message Name	Corresponding XML Message Elements
3b	ChargeParameterDiscoveryRes	ResponseCode EVSEProcessing **SAScheduleList** **SAScheduleTuple** SAScheduleTupleID **PMaxSchedule** PMaxScheduleID **PMaxScheduleEntry** **RelativeTimeInterval** start duration PMax **SalesTariff** SalesTariffID SalesTariffDescription NumEPriceLevels **SalesTariffEntry** **RelativeTimeInterval** start duration EPriceLevel ConsumptionCost startValue **Cost** costKind amount amountMultiplier **DC_EVSEChargeParameter** **DC_EVSEStatus** EVSEIsolationStatus EVSEStatusCode NotificationMaxDelay EVSENotification EVSEMaximumCurrentLimit EVSEMaximumPowerLimit EVSEMaximumVoltageLimit EVSEMinimumCurrentLimit EVSEMinimumVoltageLimit EVSECurrentRegulationTolerance EVSEPeakCurrentRipple EVSEEnergyToBeDelivered

Msg ID	XML Message Name	Corresponding XML Message Elements
4a	CableCheckReq	**DC_EVStatus** EVReady EVCabinConditioning EVRESSConditioning EVErrorCode EVRESSSOC
4b	CableCheckRes	ResponseCode EVSEProcessing **DC_EVSEStatus** EVSEIsolationStatus EVSEStatusCode NotificationMaxDelay EVSENotification
5a	Pre-ChargeReq	**DC_EVStatus** EVReady EVCabinConditioning EVRESSConditioning EVErrorCode EVRESSSOC EVTargetVoltage EVTargetCurrent
5b	Pre-ChargeRes	ResponseCode **DC_EVSEStatus** EVSEIsolationStatus EVSEStatusCode NotificationMaxDelay EVSENotification EVSEPresentVoltage
6a	PowerDeliveryReq	ReadyToChargeState **ChargingProfile** SAScheduleTupleID **ProfileEntry** ChargingProfileEntryStart ChargingProfileEntryMaxPower **DC_EVPowerDeliveryParameter** **DC_EVStatus** EVReady EVCabinConditioning EVRESSConditioning EVErrorCode EVRESSSOC BulkChargingComplete ChargingComplete

Msg ID	XML Message Name	Corresponding XML Message Elements
6b	PowerDeliveryRes	ResponseCode **DC_EVSEStatus** EVSEIsolationStatus EVSEStatusCode NotificationMaxDelay EVSENotification
7a	CurrentDemandReq	**DC_EVStatus** EVReady EVCabinConditioning EVRESSConditioning EVErrorCode EVRESSSOC EVTargetCurrent EVMaximumVoltageLimit EVMaximumCurrentLimit EVMaximumPowerLimit BulkChargingComplete ChargingComplete RemainingTimeToFullSOC RemainingTimeToBulkSOC EVTargetVoltage
7b	CurrentDemandRes	ResponseCode **DC_EVSEStatus** EVSEIsolationStatus EVSEStatusCode NotificationMaxDelay EVSENotification EVSEPresentVoltage EVSEPresentCurrent EVSECurrentLimitAchieved EVSEVoltageLimitAchieved EVSEPowerLimitAchieved EVSEMaximumVoltageLimit EVSEMaximumCurrentLimit EVSEMaximumPowerLimit

Msg ID	XML Message Name	Corresponding XML Message Elements
8a	PowerDeliveryReq	ReadyToChargeState **ChargingProfile** SAScheduleTupleID **ProfileEntry** ChargingProfileEntryStart ChargingProfileEntryMaxPower **DC_EVPowerDeliveryParameter** **DC_EVStatus** EVReady EVCabinConditioning EVRESSConditioning EVErrorCode EVRESSSOC BulkChargingComplete ChargingComplete
8b	PowerDeliveryRes	ResponseCode **DC_EVSEStatus** EVSEIsolationStatus EVSEStatusCode NotificationMaxDelay EVSENotification
9a	WeldingDetectionReq	**DC_EVStatus** EVReady EVCabinConditioning EVRESSConditioning EVErrorCode EVRESSSOC
9b	WeldingDetectionRes	ResponseCode **DC_EVSEStatus** EVSEIsolationStatus EVSEStatusCode NotificationMaxDelay EVSENotification EVSEPresentVoltage
10a	SessionStopReq	(none)
10b	SessionStopRes	ResponseCode

NOTE: Message elements may be embedded in parent message element structures identified in bold. The message elements contained in a structure are indented.

5.3 Message Sequences

5.3.1 Protocol Flow Stages and Associated Messages

After connecting PEV and EVSE, a network connection is established. Then initialization of this V2G communication session has to be done. After getting all services offered by the EVSE, charging the battery can start. At the end of the charging process, power is switched off. The following list describes the sequence of messages, which is used to control the flow:

- Initialization of V2G communication session: Check protocol compatibility, establish V2G communication session, exchange client-/server IDs. Messages for this activity:
  - Supported App Protocol Request/Response.
  - Session Setup Request/Response.
- Service Discovery: Discover the services offered by the EVSE, agreement on billing parameters. Messages for this activity:
  - Service Discovery Request/Response.
  - Service and Payment Selection Request/Response.
  - Contract Authentication Request/Response.
- Charge vehicle: Charging the PEV is one possible service offered by the EVSE. It is divided into three phases:
  - Set up charging process: Agreement on technical charging parameters, agreement on billing parameters, lock charge cord, start charging process. Messages for this activity:
    - Charge Parameter Discovery Request/Response.
    - Cable Check Request/Response.
    - PreCharge Request/Response.
    - Power Delivery Request/Response.
  - Charging process: Energy transfer.
    - Current Demand Request/Response.
  - Finalize charging process: Stop charging process, check welding, unlock charge cord.
    - Power Delivery Request/Response.
    - Welding Detection Request/Response.
    - Stop Session Request/Response.

After finalizing the charging process, the charge cord can be disconnected from the PEV.

5.3.2 Basic Definitions for Error Handling

The basic error handling for a request-response-message pair is based on the response code included in the response message of the SECC. Depending on the value in the response code, the EVCC decides if it can proceed with the standard request-response message sequence or if it has to handle an error.

In this standard, the response code as defined in Appendix C is interpreted by the EVCC as follows:

- OK: Any value starting with "OK" or "OK_" indicates a positive response. Detailed information may be provided by OK_<additional info>. This information may be used to differentiate the reaction to the positive response.

- FAILED: Any value starting with "FAILED" or "FAILED_" indicates a negative response. Detailed information may be provided by FAILED_<additional info>. This information may be used to differentiate the reaction to the negative response.

5.3.3 Response Code Usage by the SECC

Each response message the EVSE sends to the EVCC contains a ResponseCode that informs the PEV whether the previous request sent by the EVCC has been processed successfully or has resulted in an error. Successful processing is indicated by the ResponseCode value "OK" or "OK_<additional info>." Errors are indicated either by the general error value "FAILED," or by a more specific error code "FAILED_<additional info>" where "<additional info>" contains a short description of the cause of the error.

[V2G-DC-388] A response message shall contain the ResponseCode "OK" if the processing of the request message was successful. If at some point in this document, a specific positive ResponseCode is defined for a specific situation, that ResponseCode shall be used.

[V2G-DC-389] A response message shall contain the ResponseCode "FAILED" if the processing of the request message is not successful and no specific ResponseCode is defined for the concrete error case.

[V2G-DC-390] The response message shall contain the ResponseCode "FAILED_SequenceError" if the SECC has received an unexpected request message.

[V2G-DC-391] The response message shall contain the ResponseCode "FAILED_UnknownSession" if the SessionID in a request message does not match the SessionID provided by the SECC in the SessionSetupRes message.

[V2G-DC-393] The SessionSetupRes message shall contain the specific ResponseCode "OK_NewSessionEstablished" if processing of the SessionSetupReq message was successful and a different SessionID is contained in the response message than the SessionID in the request message.

[V2G-DC-395] The ServicePaymentSelectionRes message shall contain the ResponseCode "FAILED_PaymentSelectionInvalid" if the SelectedPaymentOption contained in the ServicePaymentSelectionReq message was not part of the offered PaymentOptions in the ServiceDiscoveryRes message.

[V2G-DC-396] The ServicePaymentSelectionRes message shall contain the ResponseCode "FAILED_ServiceSelectionInvalid" if the SelectedServiceList contained in the ServicePaymentSelectionReq message contains a ServiceID which was not contained in the offered ServiceList in the ServiceDiscoveryRes message.

[V2G-DC-397] The ChargeParameterDiscoveryRes message shall contain the ResponseCode "FAILED_WrongEnergyTransferType" if the content of element "EVRequestedEnergyTransferType" in the ChargeParameterDiscoveryReq message is not valid, or does not match the content of the element EVChargeParameter.

[V2G-DC-398] The ChargeParameterDiscoveryRes message shall contain the ResponseCode “FAILED_WrongChargeParameter” if the content of element EVChargeParameter in the ChargeParameterDiscoveryReq message is not valid, e.g., a wrong parameter set is provided, one or multiple parameters can not be interpreted, etc.

[V2G-DC-399] The PowerDeliveryRes message shall contain the ResponseCode “FAILED_ChargingProfileInvalid” if the content of element “ChargingProfile” in the PowerDeliveryReq message violates a power limitation provided in the “ChargeParameterDiscoveryRes” message.

[V2G-DC-400] The “PowerDeliveryRes” message shall contain the ResponseCode “FAILED_TariffSelectionInvalid” if the content of element “ChargingProfile” in the PowerDeliveryReq message contains a SAtupleID which was not contained in the “SASchedules” attribute provided in “ChargeParameterDiscoveryRes” message.

[V2G-DC-401] The PowerDeliveryRes message shall contain the ResponseCode “FAILED_PowerDeliveryNotApplied” if the EVSE is not able to deliver energy.

NOTE: Response codes that are not defined in this subsection can be user implementation specific.

An overview of the response codes and the messages is identified in 4.2 (ResponseCode).

5.3.4 Request-Response Message Sequence Requirements

5.3.4.1 EVCC Message Sequence Requirements

This section describes the EVCC Communication states for the DC V2G messaging.

5.3.4.1.1 General EVCC Sequence Requirement

[V2G-DC-645] Each request message of the message sequence as specified in 5.3.4.1.4 shall only be sent by the EVCC at that/those position(s) in the message sequence that is/are explicitly specified in requirements within this section, and under that/those condition(s) explicitly specified in the respective requirement(s), if any condition(s) is/are specified.
Exception: When, according to a requirement in this specification, the EVCC shall terminate the V2G communication session (e.g. due to an error condition), the EVCC may still send one or more request messages, e.g. in order to try to properly terminate the bidirectional communication with the EVSE, but the EVCC shall not rely on any response messages from the EVSE.

[V2G-DC-646] A change of the CP State shall only be caused by the EVCC at that/those position(s) in the message sequence that is/are explicitly specified in requirements within this section, and under that/those condition(s) explicitly specified in the respective requirement(s), if any condition(s) is/are specified.
Exception: CP State changes that are specified in standards referenced by SAE J1772, are also permissible.

[V2G-DC-647] During the charging session, the EVCC shall continuously monitor the CP duty cycle for any change.

5.3.4.1.2 EVCC Requirements for Premature Intentional Termination

[V2G-DC-648] If the EVCC wishes to stop the communication session for a non-critical reason (e.g., user interaction) after having sent a SessionSetupReq message and before having sent a PowerDeliveryReq message with ReadyToChargeState equal to “TRUE,” the EVCC should not immediately change the CP State, unless this is required by another requirement in this document, but the EVCC shall send a SessionStopReq message as the next request message and then wait for a SessionStopRes message. It shall then proceed according to [V2G-DC-413], [V2G-DC-750], [V2G-DC-657], and [V2G-DC-658].

[V2G-DC-673] If the EVCC wishes to stop the communication session for a non-critical reason (e.g., user interaction) after having sent a CurrentDemandReq message and before having sent a PowerDeliveryReq message with ReadyToChargeState equal to "FALSE," the EVCC shall not immediately change the CP State, unless this is required by another requirement in this document, but the EVCC shall send a PowerDeliveryReq message with ReadyToChargeState equal to "FALSE" as the next request message and then wait for a PowerDeliveryRes message. It shall then proceed according to [V2G-DC-747], [V2G-DC-502], [V2G-DC-427], [V2G-DC-428], and so on.

NOTE: If the EVCC wishes to stop the communication session for a non-critical reason (e.g., user interaction) after having sent a PowerDeliveryReq message with ReadyToChargeState equal to "TRUE" and before having sent a CurrentDemandReq message, the EVCC, in accordance with [V2G-DC-424], shall send a CurrentDemandReq message; e.g., with EVTargetCurrent equal to 0 A, and wait for a CurrentDemandRes message before continuing according to [V2G-DC-424].

[V2G-DC-649] Before having sent a ChargeParameterDiscoveryReq message, if the EVCC receives a response message that it expects in response to the latest request message sent, and this response message contains ResponseCode equal to "FAILED," and the EVCC detects that the CP oscillator is not turned off, the EVCC shall proceed as if the EVCC itself wished to stop the communication session for a non-critical reason according to [V2G-DC-648].

NOTE: Please see 5.3.2 concerning values of ResponseCode starting with "FAILED" or "FAILED_."

[V2G-DC-650] If the EVCC receives a response message that it expects in response to the latest request message sent, and this response message contains EVSEStatusCode equal to "EVSE_Shutdown," the EVCC shall proceed as if the EVCC itself wished to stop the communication session for a non-critical reason according to [V2G-DC-648] and [V2G-DC-673].

NOTE: If the parameter EVSEStatusCode equal to "EVSE_Shutdown" is contained in a PowerDeliveryRes message sent in response to a PowerDeliveryReq message with ReadyToChargeState equal to "TRUE," the EVCC, in accordance with [V2G-DC-424] shall send a CurrentDemandReq message, e.g., with EVTargetCurrent equal to "0 A" (zero ampere), and wait for a CurrentDemandRes message before continuing according to [V2G-DC-673].

5.3.4.1.3 EVCC Requirements for Error Shutdown

[V2G-DC-651] If the EVCC receives a response message that it expects in response to the latest request message sent, and if the EVCC cannot process this response message, e. g. due to errors in the message parameters or due to impeding conditions in the EV, the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

[V2G-DC-652] Before having sent a ChargeParameterDiscoveryReq message, if the EVCC receives a response message that it expects in response to the latest request message sent, and this response message contains ResponseCode equal to "FAILED," and the EVCC detects that the CP oscillator is turned off, the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

NOTE: Please see 5.3.2 concerning values of ResponseCode starting with "FAILED" or "FAILED_."

[V2G-DC-653] After having sent a ChargeParameterDiscoveryReq message, if the EVCC receives a response message that it expects in response to the latest request message sent, and this response message contains ResponseCode equal to “FAILED,” the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

NOTE 1: Please see 5.3.2 concerning values of ResponseCode starting with “FAILED” or “FAILED_.”

NOTE 2: According to SAE J1772, if the SECC detects an unexpected CP State B, the SECC carries out, without any delay, an “EVSE-initiated emergency shutdown,” which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-402] At any point in time in the V2G communication session, if the EVCC receives a response message that it does not expect in response to the latest request message sent, the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

NOTE: According to SAE J1772, if the SECC detects an unexpected CP State B, the SECC carries out, without any delay, an “EVSE-initiated emergency shutdown,” which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-654] If the EVCC receives a response message that it expects in response to the latest request message sent, and this response message contains ResponseCode equal to “FAILED_SequenceError,” the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

NOTE: According to SAE J1772, if the SECC detects an unexpected CP State B, the SECC carries out, without any delay, an “EVSE-initiated emergency shutdown,” which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-655] At any point in time in the V2G communication session, if the EVCC detects CP State E or CP State F, the EVCC shall close the TCP connection according to [V2G-DC-107].

[V2G-DC-656] At any time in the communication session after having received a ChargeParameterDiscoveryRes message, if the EVCC detects that the CP duty cycle is not 5%, the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

NOTE: Other errors in the charging application than the ones mentioned in this section might also cause an error shutdown by the EV. For further information, please refer to SAE J1772.

5.3.4.1.4 Normal EVCC Message Sequence

[V2G-DC-738] Before initiating the V2G communication session, the EVCC shall be in CP State B.

[V2G-DC-403] After the TCP connection is established, in order to initiate the V2G communication session according to [V2G-DC-106] the EVCC shall send a supportedAppProtocolReq message as the first application layer message of a V2G communication session and shall then wait for a supportedAppProtocolRes message.

[V2G-DC-739] When waiting for a supportedAppProtocolRes message, if the EVCC receives a supportedAppProtocolRes message, the EVCC shall process this response message.

[V2G-DC-405] After the EVCC has successfully processed a received supportedAppProtocolRes, message with ResponseCode equal to "OK_SuccessfulNegotiation" or "OK_SuccessfulNegotiationWithMinorDeviation," the EVCC shall send a SessionSetupReq message and shall then wait for a SessionSetupRes message.

[V2G-DC-740] When waiting for a SessionSetupRes message, if the EVCC receives a SessionSetupRes message, the EVCC shall process this response message.

[V2G-DC-407] After the EVCC has successfully processed a received SessionSetupRes message with ResponseCode equal to "OK," the EVCC shall send a ServiceDiscoveryReq message and shall then wait for a ServiceDiscoveryRes message.

[V2G-DC-741] When waiting for a ServiceDiscoveryRes message, if the EVCC receives a ServiceDiscoveryRes message, the EVCC shall process this response message.

[V2G-DC-409] After the EVCC has successfully processed a received ServiceDiscoveryRes message with ResponseCode equal to "OK," the EVCC shall send a ServicePaymentSelectionReq message and shall then wait for a ServicePaymentSelectionRes message.

NOTE: There are no service details needed within the scope of this document.

[V2G-DC-742] When waiting for a ServicePaymentSelectionRes message, if the EVCC receives a ServicePaymentSelectionRes message, the EVCC shall process this response message.

[V2G-DC-414] After the EVCC has successfully processed a received ServicePaymentSelectionRes message with ResponseCode equal to "OK," the EVCC shall send a ContractAuthenticationReq message and shall then wait for a ContractAuthenticationRes message.

[V2G-DC-743] When waiting for a ContractAuthenticationRes message, if the EVCC receives a ContractAuthenticationRes message, the EVCC shall process this response message.

[V2G-DC-492] After the EVCC has successfully processed a received ContractAuthenticationRes message with ResponseCode equal to "OK" and EVSEProcessing equal to "Ongoing," the EVCC shall resend the identical ContractAuthenticationReq message as before and shall then wait for a ContractAuthenticationRes message.

NOTE: In order to avoid a timeout by V2G_EVCC_Msg_Timer reaching or exceeding V2G_EVCC_Msg_Timeout, the SECC may use EVSEProcessing equal to "Ongoing" in ContractAuthenticationRes to inform the EVCC that the SECC is still processing the requested contract authentication.

[V2G-DC-490] After the EVCC has successfully processed a received ContractAuthenticationRes message with ResponseCode equal to "OK" and EVSEProcessing equal to "Finished," the EVCC shall send a ChargeParameterDiscoveryReq message and shall then wait for a ChargeParameterDiscoveryRes message.

[V2G-DC-744] When waiting for a ChargeParameterDiscoveryRes message, if the EVCC receives a ChargeParameterDiscoveryRes message, the EVCC shall process this response message.

[V2G-DC-493] After the EVCC has successfully processed a received ChargeParameterDiscoveryRes message with ResponseCode equal to “OK” and EVSEProcessing equal to “Ongoing,” the EVCC shall ignore the values of SAScheduleList and DC_EVSEChargeParameter contained in this ChargeParameterDiscoveryRes message, and shall resend the identical ChargeParameterDiscoveryReq message as before and shall then wait for a ChargeParameterDiscoveryRes message.

NOTE: In order to avoid a timeout by V2G_EVCC_Msg_Timer reaching or exceeding V2G_EVCC_Msg_Timeout, the SECC may use EVSEProcessing equal to “Ongoing” in the ChargeParameterDiscoveryRes message to inform the EVCC that the SECC is still processing the requested charge parameter discovery.

[V2G-DC-501] Before sending a CableCheckReq message, the EVCC shall change to CP State C or D as defined in SAE J1772

[V2G-DC-415] After the EVCC has successfully processed a received ChargeParameterDiscoveryRes message with ResponseCode equal to “OK” and EVSEProcessing equal to “Finished,” the EVCC shall send a CableCheckReq message and shall then wait for a CableCheckRes message.

[V2G-DC-745] When waiting for a CableCheckRes message, if the EVCC receives a CableCheckRes message, the EVCC shall process this response message.

[V2G-DC-418] After the EVCC has successfully processed a received CableCheckRes message with ResponseCode equal to “OK” and EVSEProcessing equal to “Ongoing” while V2G_EVCC_CableCheck_Timer is smaller than V2G_EVCC_CableCheck_Timeout, the EVCC shall resend the identical CableCheckReq message as before and shall then wait for a CableCheckRes message.

NOTE: In order to avoid a timeout by V2G_EVCC_Msg_Timer reaching or exceeding V2G_EVCC_Msg_Timeout, the SECC may use EVSEProcessing equal to “Ongoing” in the CableCheckRes message to inform the EVCC that the SECC is still processing the requested cable check.

[V2G-DC-417] After the EVCC has successfully processed a received CableCheckRes message with ResponseCode equal to “OK” and EVSEProcessing equal to “Finished,” the EVCC shall send a PreChargeReq message and shall then wait for a PreChargeRes message.

[V2G-DC-746] When waiting for a PreChargeRes message, if the EVCC receives a PreChargeRes message, the EVCC shall process this response message.

[V2G-DC-421] After the EVCC has successfully processed a received PreChargeRes message with ResponseCode equal to “OK,” if the PEV determines that the EVSE output voltage, as measured inside the PEV, has sufficiently been adjusted to the PEV RESS voltage, the EVCC shall send a PowerDeliveryReq message with ReadyToChargeState equal to “TRUE” and shall then wait for a PowerDeliveryRes message.

[V2G-DC-422] After the EVCC has successfully processed a received PreChargeRes message with ResponseCode equal to “OK,” if the PEV determines that the EVSE output voltage, as measured inside the PEV, has not sufficiently been adjusted to the PEV RESS voltage, the EVCC shall send another PreChargeReq message and shall then wait for a PreChargeRes message.

NOTE: Refer to SAE J1772 for pre-charge details.

[V2G-DC-747] When waiting for a PowerDeliveryRes message, if the EVCC receives a PowerDeliveryRes message, the EVCC shall process this response message.

[V2G-DC-424] After the EVCC has successfully processed a received PowerDeliveryRes message with ResponseCode equal to “OK” as a response to a previous PowerDeliveryReq message with ReadyToChargeState equal to “TRUE,” the EVCC shall send a CurrentDemandReq message and shall then wait for a CurrentDemandRes message.

[V2G-DC-748] When waiting for a CurrentDemandRes message, if the EVCC receives a CurrentDemandRes message, the EVCC shall process this response message.

[V2G-DC-425] After the EVCC has successfully processed a received CurrentDemandRes message with ResponseCode equal to “OK,” if the charging process shall be continued, the EVCC shall send another CurrentDemandReq, message and shall then wait for a CurrentDemandRes message.

[V2G-DC-420] After the EVCC has successfully processed a received CurrentDemandRes message with ResponseCode equal to “OK,” if the charging process shall be stopped, the EVCC shall send a PowerDeliveryReq message with ReadyToChargeState equal to “FALSE,” and shall then wait for a PowerDeliveryRes message.

[V2G-DC-502] After sending a PowerDeliveryReq message with ReadyToChargeState equal to “FALSE” and receiving the corresponding PowerDeliveryRes message, the EVCC shall change to CP State B as defined in SAE J1772 before sending the next request message.

[V2G-DC-427] After the EVCC has successfully processed a received PowerDeliveryRes message with ResponseCode equal to “OK” as a response to a previous PowerDeliveryReq message with ReadyToChargeState equal to “FALSE,” if the PEV wishes to perform a Welding Detection, the EVCC shall send a WeldingDetectionReq message and shall then wait for a WeldingDetectionRes message.

[V2G-DC-428] After the EVCC has successfully processed a received PowerDeliveryRes message with ResponseCode equal to “OK” as a response to a previous PowerDeliveryReq message with ReadyToChargeState equal to “FALSE,” if the PEV does not wish to perform a Welding Detection, the EVCC shall send a SessionStopReq message and shall then wait for a SessionStopRes message.

[V2G-DC-749] When waiting for a WeldingDetectionRes message, if the EVCC receives a WeldingDetectionRes message, the EVCC shall process this response message.

[V2G-DC-430] After the EVCC has successfully processed a received WeldingDetectionRes message with ResponseCode equal to “OK,” if the Welding Detection function is finished on the PEV side, the EVCC shall send a SessionStopReq message and shall then wait for a SessionStopRes message.

[V2G-DC-431] After the EVCC has successfully processed a received WeldingDetectionRes message with ResponseCode equal to “OK,” if the Welding Detection function has not yet finished on the PEV side, the EVCC shall send another WeldingDetectionReq message and shall then wait for a WeldingDetectionRes message.

NOTE: See SAE J1772 for welding detection details.

[V2G-DC-413] When waiting for a SessionStopRes message, if the EVCC receives a SessionStopRes message, the EVCC shall process this response message.

[V2G-DC-750] After the EVCC has successfully processed a received SessionStopRes message, the EVCC shall change to CP State B as defined in SAE J1772 if the EVCC is not in CP State B.

NOTE: Changing to CP State B after processing a received SessionStopRes message is necessary in some cases when the EVCC wishes to stop the communication session for a non-critical reason according to [V2G-DC-648].

[V2G-DC-657] After the EVCC has successfully processed a received SessionStopRes message with ResponseCode equal to “OK,” the V2G communication session is properly stopped and the EVCC shall close the TCP connection according to [V2G-DC-107].

[V2G-DC-658] After the EVCC has successfully processed a received SessionStopRes message with ResponseCode not equal to “OK,” the V2G communication session is stopped with an error and the EVCC shall close the TCP connection according to [V2G-DC-107].

5.3.4.2 SECC Message Sequence Requirements

This section describes the SECC Communication states for the DC V2G messaging.

5.3.4.2.1 General SECC Sequence Requirement

[V2G-DC-659] Each response messages of the message sequence as specified in 5.3.4.2.4 shall only be sent by the SECC at that/those position(s) in the message sequence that is/are explicitly specified in requirements within this section, and under that/those condition(s) explicitly specified in the respective requirement(s), if any condition(s) is/are specified.

Exception: When, according to a requirement in this specification, the SECC shall terminate the V2G communication session (e.g., due to an error condition), the SECC may still send one or more response messages, e.g., in order to try to properly terminate the bidirectional communication with the EVCC, but the SECC shall not rely on any request messages from the EV.

[V2G-DC-660] A change of the CP duty cycle shall only be caused by the SECC at that/those position(s) in the message sequence that is/are explicitly specified in requirements within this section, and under that/those condition(s) explicitly specified in the respective requirement(s), if any condition(s) is/are specified. **Exception:** CP State changes that are specified in standards referenced by this document, e.g., SAE J1772, are also permissible

[V2G-DC-661] During the charging session, the SECC shall continuously monitor the CP State for any change between CP State A, B, C, and D.

5.3.4.2.2 SECC Requirements for Premature Intentional Termination

[V2G-DC-662] If the SECC wishes to stop the communication session for a non-critical reason (e.g., user interaction) after having received a supportedAppProtocolReq message and before having sent a ContractAuthenticationRes message, the SECC shall send the next response message with parameter ResponseCode equal to "FAILED," but the SECC shall not turn off the CP oscillator unless this is required by another requirement in this document.

[V2G-DC-663] If the SECC wishes to stop the communication session for a non-critical reason (e.g., user interaction) after having sent a ContractAuthenticationRes message, the SECC shall send the next response message with parameter EVSEStatusCode equal to "EVSE_Shutdown," even if another requirement in this document specifies that a different value for EVSEStatusCode shall be used, but the SECC shall not turn off the CP oscillator unless this is required by another requirement in this document.

NOTE 1: After the SECC informs the EVCC according to [V2G-DC-662] or [V2G-DC-663] that the SECC wishes to stop the communication session, the further steps are controlled by the EVCC according to [V2G-DC-649] and [V2G-DC-650].

NOTE 2: If the SECC uses the parameter EVSEStatusCode equal to "EVSE_Shutdown" in a PowerDeliveryRes message sent in response to a PowerDeliveryReq message with ReadyToChargeState equal to "TRUE," the EVCC, in accordance with [V2G-DC-424], shall send a CurrentDemandReq message and wait for a CurrentDemandRes message before continuing according to [V2G-DC-673].

[V2G-DC-664] During a V2G communication session, after having sent a SessionSetupRes message and before having received a PowerDeliveryReq message with ReadyToChargeState equal to "TRUE," if the SECC receives a SessionStopReq message, it shall proceed according to [V2G-DC-450], [V2G-DC-451], and [V2G-DC-672].

5.3.4.2.3 SECC Requirements for Error Shutdown

[V2G-DC-665] If the SECC receives a request message that it expects according to the message sequence specified in this section, and if the SECC cannot process this request message, e.g., due to errors in the message parameters or due to impeding conditions in the EVSE, the SECC shall:

- Without any delay, carry out an "EVSE-initiated emergency shutdown" as specified in SAE J1772, which includes turning off the CP oscillator, if it is turned on,
- Respond with the corresponding response message with parameter ResponseCode equal to "FAILED,"
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-116].

NOTE: According to SAE J1772, when the SECC carries out an "EVSE emergency shutdown," it also performs a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-666] At any point in time in the V2G communication session, if the SECC receives a request message that it does not expect according to the message sequence specified in this section, the SECC shall:

- Without any delay, carry out an "EVSE-initiated emergency shutdown" as specified in SAE J1772, which includes turning off the CP oscillator, if it is turned on,
- Respond with the response message corresponding to the received unexpected request message with parameter ResponseCode equal to "FAILED_SequenceError,"
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-116].

NOTE: According to [V2G-DC-116], when the SECC carries out an "EVSE emergency shutdown," it also performs a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-667] At any point in time in the V2G communication session, if the SECC detects CP State A, the SECC shall close the TCP connection according to [V2G-DC-116].

NOTE: According to SAE J1772, if the SECC detects CP State A or an unexpected CP State B, it carries out, without any delay, an "EVSE-initiated emergency shutdown" which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-668] While monitoring the CP State, if the SECC detects CP State B according to 5.3.4.1.4 and 5.3.4.2.4, it should detect CP State C, the SECC shall close the TCP connection according to [V2G-DC-116].

NOTE: According to SAE J1772, if the SECC detects an unexpected CP State B, the SECC carries out, without any delay, an "EVSE-initiated emergency shutdown," which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-669] At any point in time in the V2G communication session, if the SECC changes to CP State E but remains operational (i.e., no complete power outage, for example), the SECC shall close the TCP connection according to [V2G-DC-116].

[V2G-DC-670] At any point in time in the V2G communication session, if the SECC changes to CP State F, the SECC shall close the TCP connection according to [V2G-DC-116].

NOTE: Other errors in the charging application than the ones mentioned in this section might also cause an error shutdown by the EVSE. For further information, please refer to SAE J1772.

5.3.4.2.4 Normal SECC Message Sequence

[V2G-DC-432] After the TCP connection is established, in order to initiate the V2G communication session according to [V2G-DC-106], the SECC shall, set the timeout V2G_SECC_Sequence_Timeout to the value as defined in Table 2 for the supportedAppProtocolReq message. It shall then reset and start the V2G_SECC_Sequence_Timer and it shall start to continuously monitor the V2G_SECC_Sequence_Timer for reaching or exceeding V2G_SECC_Sequence_Timeout. The SECC shall then wait for a supportedAppProtocolReq message.

NOTE: Before receiving the first message from the EVCC, the SECC has not sent any response message yet. Therefore, the SECC has to start its V2G SECC Sequence Timer when starting to wait for the first message.

[V2G-DC-436] When waiting for a supportedAppProtocolReq message, if the SECC receives a supportedAppProtocolReq message, the SECC shall process this request message.

[V2G-DC-437] After the SECC has successfully processed a received supportedAppProtocolReq message, the SECC shall respond with a supportedAppProtocolRes message with ResponseCode according to Table 5. The SECC shall then wait for a SessionSetupReq message.

[V2G-DC-438] When waiting for a SessionSetupReq message, if the SECC receives a SessionSetupReq message, the SECC shall process this request message.

[V2G-DC-439] After the SECC has successfully processed a received SessionSetupReq message, the SECC shall respond with a SessionSetupRes message with ResponseCode equal to "OK." The SECC shall then wait for a ServiceDiscoveryReq message or a SessionStopReq message.

[V2G-DC-440] When waiting for a ServiceDiscoveryReq message, if the SECC receives a ServiceDiscoveryReq message, the SECC shall process this request message.

[V2G-DC-441] After the SECC has successfully processed a received ServiceDiscoveryReq message, the SECC shall respond with a ServiceDiscoveryRes message with ResponseCode equal to "OK." The SECC shall then wait for a ServicePaymentSelectionReq message or a SessionStopReq message.

[V2G-DC-443] When waiting for a ServicePaymentSelectionReq message, if the SECC receives a ServicePaymentSelectionReq message, the SECC shall process this request message.

[V2G-DC-444] After the SECC has successfully processed a received ServicePaymentSelectionReq message, the SECC shall respond with a ServicePaymentSelectionRes message with ResponseCode equal to "OK." The SECC shall then wait for a ContractAuthenticationReq message or a SessionStopReq message.

[V2G-DC-494] When waiting for a ContractAuthenticationReq message, if the SECC receives a ContractAuthenticationReq message, the SECC shall process this request message.

[V2G-DC-495] After the SECC has successfully processed a received ContractAuthenticationReq message, the SECC shall respond with a ContractAuthenticationRes message with ResponseCode equal to "OK" and EVSEProcessing equal to "Finished," if the contract authentication has finished on EVSE side. The SECC shall then wait for a ChargeParameterDiscoveryReq message or a SessionStopReq message.

[V2G-DC-497] After the SECC has successfully processed a received ContractAuthenticationReq message, the SECC shall respond with a ContractAuthenticationRes message with ResponseCode equal to "OK" and EVSEProcessing equal to "Ongoing," if the contract authentication has not yet finished on EVSE side. The SECC shall then wait for another ContractAuthenticationReq message or a SessionStopReq message.

[V2G-DC-445] When waiting for a ChargeParameterDiscoveryReq message, if the SECC receives a ChargeParameterDiscoveryReq message, the SECC shall process this request message.

[V2G-DC-671] An EVSE that supports also other charging types than DC charging according to SAE J2847-2 on a connector shall, if by means of the parameter "EVRequestedEnergyTransferType" in ChargeParameterDiscoveryReq, the EVCC requests DC charging according to SAE J2847-2, apply a CP duty cycle of 5% on this connector at the latest before responding with a ChargeParameterDiscoveryRes message with ResponseCode equal to "OK" unless an error condition requires applying a different CP duty cycle or CP voltage.

[V2G-DC-453] After the SECC has successfully processed a received ChargeParameterDiscoveryReq message, the SECC shall respond with a ChargeParameterDiscoveryRes message with ResponseCode equal to "OK," EVSEStatusCode equal to "EVSE_Ready," and EVSEProcessing equal to "Finished," if the determination of the charge parameters has finished on EVSE side. The SECC shall then wait for a CableCheckReq message or a SessionStopReq message.

[V2G-DC-498] After the SECC has successfully processed a received ChargeParameterDiscoveryReq message, the SECC shall respond with a ChargeParameterDiscoveryRes message with ResponseCode equal to "OK," EVSEStatusCode equal to "EVSE_Ready," and EVSEProcessing equal to "Ongoing," if the determination of the charge parameters has not yet finished on EVSE side. The SECC shall then wait for another ChargeParameterDiscoveryReq message or a SessionStopReq message.

[V2G-DC-547] After the SECC has sent a ChargeParameterDiscoveryRes message with ResponseCode equal to "OK," EVSEStatusCode equal to "EVSE_Ready," and EVSEProcessing equal to "Finished," if the SECC fails to detect CP State C as defined in SAE J1772 at the latest V2G_SECC_CPState_Detection_Timeout after receiving a CableCheckReq message, the SECC shall:

- Without any delay, carry out an "EVSE-initiated emergency shutdown" as specified in SAE J1772, which includes turning off the CP oscillator, if it is turned on,
- Respond with a CableCheckRes message with parameter ResponseCode equal to "FAILED,"
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-116].

[V2G-DC-454] When waiting for a CableCheckReq message, if the SECC receives a CableCheckReq message, the SECC shall process this request message.

[V2G-DC-455] After the SECC has successfully processed a received CableCheckReq message, the SECC shall respond with a CableCheckRes message with ResponseCode equal to "OK" EVSEStatusCode equal to "EVSE_Ready," and EVSEProcessing equal to "Finished," if the Cable Check has finished on EVSE side. The SECC shall then wait for a PreChargeReq message or a SessionStopReq message.

[V2G-DC-499] After the SECC has successfully processed a received CableCheckReq message, the SECC shall respond with a CableCheckRes message with ResponseCode equal to "OK," EVSEStatusCode equal to "EVSE_IsolationMonitoringActive," and EVSEProcessing equal to "Ongoing," if the Cable Check has not yet finished on EVSE side. The SECC shall then wait for another CableCheckReq message or a SessionStopReq message.

[V2G-DC-457] When waiting for a PreChargeReq message, if the SECC receives a PreChargeReq message, the SECC shall process this request message.

[V2G-DC-458] After the SECC has successfully processed a received PreChargeReq message the SECC shall respond with a PreChargeRes message with ResponseCode equal to "OK." The SECC shall then wait for another PreChargeReq message, a PowerDeliveryReq message, or a SessionStopReq message.

[V2G-DC-461] When waiting for a PowerDeliveryReq message, if the SECC receives a PowerDeliveryReq message, the SECC shall process this request message.

[V2G-DC-462] After the SECC has successfully processed a received PowerDeliveryReq message, and if the received PowerDeliveryReq message contained ReadyToChargeState equal to "TRUE," the SECC shall respond with a PowerDeliveryRes message with ResponseCode equal to "OK." The SECC shall then wait for a CurrentDemandReq message.

[V2G-DC-464] When waiting for a CurrentDemandReq message, if the SECC receives a CurrentDemandReq message, the SECC shall process this request message.

[V2G-DC-465] After the SECC has successfully processed a received CurrentDemandReq message, the SECC shall respond with a CurrentDemandRes message with ResponseCode equal to "OK." The SECC shall then wait for another CurrentDemandReq message or a PowerDeliveryReq message.

[V2G-DC-459] After the SECC has successfully processed a received PowerDeliveryReq message, and, if the received PowerDeliveryReq message contained "ReadyToChargeState equal to "FALSE," the SECC shall respond with a PowerDeliveryRes message with ResponseCode equal to "OK." The SECC shall then wait for a WeldingDetectionReq message or a SessionStopReq message.

[V2G-DC-556] After the SECC has sent a PowerDeliveryRes message in response to a PowerDeliveryReq message with ReadyToChargeState equal to "FALSE," if the SECC fails to detect CP State B as defined in SAE J1772 at the latest V2G_SECC_CPState_Detection_Timeout according to Table 4 after receiving the next request message, the SECC shall:

- Without any delay, carry out an "EVSE-initiated emergency shutdown" as specified in SAE J1772, which includes turning off the CP oscillator, if it is turned on,
- Respond with the corresponding response message with parameter ResponseCode equal to "FAILED,"
- Terminate the V2G communication session, and close the TCP connection according to [V2G-DC-116].

[V2G-DC-468] When waiting for a WeldingDetectionReq message, if the SECC receives a WeldingDetectionReq message, the SECC shall process this request message.

[V2G-DC-469] After the SECC has successfully processed a received WeldingDetectionReq message, the SECC shall respond with a WeldingDetectionRes message with ResponseCode equal to "OK." The SECC shall then wait for another WeldingDetectionReq message or a SessionStopReq message.

[V2G-DC-450] When waiting for a SessionStopReq message, if the SECC receives a SessionStopReq message, the SECC shall process this request message.

[V2G-DC-451] After the SECC has successfully processed a received SessionStopReq message, the SECC shall respond with a SessionStopRes message with ResponseCode equal to "OK."

[V2G-DC-672] After the SECC has sent a SessionStopRes message with ResponseCode equal to "OK," it shall keep the CP oscillator switched on for V2G_SECC_CPOscillator_Retain_Time according to Table 4. The SECC shall then switch the CP oscillator off.

5.4 Request Message Parameters (Mandatory/Optional) Modes

M means that the respective schema element is mandatory as per the schema definition, or that it is optional as per the schema definition but the use of it is mandatory in the corresponding message.

O means that the respective schema element is optional as per the schema definition, and the use of it is optional in the corresponding message.

N/A means that the respective schema element is optional as per the schema definition, but that it shall not be used in the corresponding message.

MP means that the respective schema element is optional as per the schema definition; however, if it is used by the sender of the message, the receiver of the message shall process this element.

Table 99 - Request message parameters modes

									Energy Transfer			Welding Check and Termination	
	EV Signals & Messages	Initialization							Pre-Charge				
		SupportedAppProtocolReq (0a)	SessionSetupReq (1a)	ServiceDiscoveryReq (2a)	ServicePaymentSelectionReq (Xa)	Contract AuthenticationReq (Ya)	ChargeParameterDiscoveryReq (3a)	CableCheckReq (4a)	Pre-ChargeReq (5a)	PowerDeliveryReq (6a & 8a)	CurrentDemandReq (7a)	WeldingDetectionReq (9a)	SessionStopReq (10a)
1	Bulk Charging Complete									O	O		
2	Bulk SOC						O						
3	Charging Complete									M	M		
4	Charging Profile									O MP			
5	Charging Profile Entry Max Power									O MP			
6	Charging Profile Entry Start									O MP			
7	Contract				N/U								
8	DC EV Charge Parameter						M						
9	DC EV Power Delivery Parameter									M			
10	DC EV Status						M	M	M	M	M	M	
11	EV Cabin Conditioning						O	O	O	O	O	O	
12	EV Energy Capacity						O						
13	EV Energy Request						O						
14	EV Error Code						M	M	M	M	M	M	
15	EV Maximum Current Limit						O MP				O MP		
16	EV Maximum Power Limit						O				O		
17	EV Maximum Voltage Limit						O MP				O MP		
18	EV Ready						M	M	M	M	M	M	

												Energy Transfer	Welding Check and Termination	
	EV Signals & Messages	Initialization							Pre-Charge					
		SupportedAppProtocolReq (0a)	SessionSetupReq (1a)	ServiceDiscoveryReq (2a)	ServicePaymentSelectionReq (Xa)	Contract AuthenticationReq (Ya)	ChargeParameterDiscoveryReq (3a)	CableCheckReq (4a)	Pre-ChargeReq (5a)	PowerDeliveryReq (6a & 8a)	CurrentDemandReq (7a)	WeldingDetectionReq (9a)	SessionStopReq (10a)
19	EV Requested Energy Transfer Type						M						
20	EV RESS Conditioning						O	O	O	O	O	O	
21	EV RESS SOC						M	M	M	M	M	M	
22	EV Target Current								M		M		
23	EV Target Voltage								M		M		
24	EVCC ID		M										
25	External Payment				N/U								
26	Full SOC						O						
27	General Challenge					N/U							
28	ID					N/U							
29	Parameter Set ID				N/U								
30	Priority	M											
31	Profile Entry									M			
32	Protocol Namespace	M											
33	Ready to Charge State									M			
34	Remaining Time to bulk SOC										O		
35	Remaining Time to Full SOC										O		
36	SA Schedule Tuple ID									M			
37	Schema ID	MP											
38	Selected Payment Option				N/U								
39	Selected Service				N/U								
40	Selected Service List				N/U								
41	Service Category			M									
42	Service ID				N/U								
43	Service Scope			O									
44	Version Number Major	M											
45	Version Number Minor	M											

NOTES:
- The table shows what signals are used in particular message structures.
- The signal is noted as optional (“O”) or mandatory (“M”) to be transmitted within specific messages, as shown in the table.
- In some cases, a signal is required to send, but the receiver does not have to do anything to handle that signal.
- Optional signals do not need to be transmitted, and the receiver should not issue a fault in the absence of optional signals.

5.5 Response Message Parameters (Mandatory/Optional) Modes

Table 100 - Response message parameters modes

	EVSE Signals & Messages	Initialization							Pre-Charge	Energy Transfer		Welding Check and Termination	
		SupportedAppProtocolRes (0b)	SessionSetupRes (1b)	ServiceDiscoveryRes (2b)	ServicePaymentSelectionRes (Xb)	Contract AuthenticationRes (Yb)	ChargeParameterDiscoveryRes (3b)	CableCheckRes (4b)	Pre-ChargeRes (5b)	PowerDeliveryRes (6b & 8b)	CurrentDemandRes (7b)	WeldingDetectionRes (9b)	SessionStopRes (10b)
1	Charge Service			M									
2	Date Time Now		O										
3	DC EVSE Charge Parameter						M						
4	DC EVSE Status						M	M	M	M	M	M	
5	Duration						MP O						
6	Energy Transfer Type			M									
7	EVSE Current Limit Achieved										M		
8	EVSE Current Regulation Tolerance						O						
9	EVSE Energy to be Delivered						O						
10	EVSE ID		M										
11	EVSE Isolation Status						O	O	O	O	O	O	
12	EVSE Maximum Current Limit						MP O				MP O		
13	EVSE Maximum Power Limit						MP O				MP O		
14	EVSE Maximum Voltage Limit						MP O				MP O		
15	EVSE Minimum Current Limit						M						
16	EVSE Minimum Voltage Limit						M						
17	EVSE Notification						O	O	O	O	O	O	
18	EVSE Peak Current Ripple						M						
19	EVSE Power Limit Achieved										M		
20	EVSE Present Current										M		
21	EVSE Present Voltage								M		M	M	
22	EVSE Processing					M	M	M					
23	EVSE Status Code						M	M	M	M	M	M	
24	EVSE Voltage Limit Achieved										M		
25	Free Service			O									
26	Notification Max Delay						O	O	O	O	O	O	
27	P Max						O						

											Energy Transfer	Welding Check and Termination	
	EVSE Signals & Messages	Initialization							Pre-Charge				
		SupportedAppProtocolRes (0b)	SessionSetupRes (1b)	ServiceDiscoveryRes (2b)	ServicePaymentSelectionRes (Xb)	Contract AuthenticationRes (Yb)	ChargeParameterDiscoveryRes (3b)	CableCheckRes (4b)	Pre-ChargeRes (5b)	PowerDeliveryRes (6b & 8b)	CurrentDemandRes (7b)	WeldingDetectionRes (9b)	SessionStopRes (10b)
28	P Max Schedule						O						
29	P Max Schedule Entry						O						
30	P Max Schedule ID						O						
31	Payment Option			N/U									
32	Physical Value Type												
33	Relative Time Interval						M						
34	Response Code	M	M	M	N/A	N/A	M	M	M	M	M	M	M
35	SA Schedule List						M						
36	SA Schedule Tuple						M						
37	SA Schedule Tuple ID						M						
38	Schema ID	O											
39	Service Category			O M									
40	Service Charge Type			M									
41	Service ID			M									
42	Service List			O									
43	Service Name			O									
44	Service Scope			O									
45	Service Tag			M									
46	Service Tag Type			M									
47	Start						M						

NOTES:
- The above table shows what signals are used in particular message structures.
- The signal is noted as optional ("O") or mandatory ("M") to be transmitted within specific messages, as shown in the table.
- In some cases, a signal is required to send, but the receiver does not have to do anything to handle that signal.
- Optional signals do not need to be transmitted, and the receiver should not issue a fault in the absence of optional signals.

5.6 Session Timing and Error Handling

5.6.1 Overview

This section describes the timing and error handling for the V2G communication session. The error handling is—among other things—based on timers enabling the EVCC and the SECC to monitor the V2G message exchange. For the detection of missing or delayed messages the EVCC and the SECC use predefined timeout values as error criteria. Whenever a timer is equal to or larger than the related timeout, the related error handling is processed.

It is important to understand that all timers, timeouts, and performance times specified in this section are merely means to describe the temporal behaviour of the EVCC and the SECC required by this standard. While the EVCC and the SECC are required to exhibit a temporal behavior and an error handling behavior as described in this section by means of timers, timeouts, and performance times, it is not necessary that all timers and timeouts actually be implemented exactly as described herein, or be implemented at all, respectively.

A timer counts the duration from the last time it was reset and then started. The instantaneous value of a timer is the duration from its most recent reset and start time to the present time. The monitoring of the V2G communication message exchange is based on two timer categories:

- Message Timer: Monitors the exchange of a request message and the corresponding response message (request-response-pair);

- Sequence Timer: Monitors a response-request message sequence.

To enable error handling for a V2G communication session setup the EVCC monitors the time between plug-in and the reception of the SessionSetupRes message and the PowerDeliveryRes message, respectively. This allows the EVCC to decide about a successful or failed communication session setup after the defined timeouts.

The monitoring of a V2G communication session is based on two timer categories:

- Communication Setup Timer: Monitors the time from plug-in until reception of the SessionSetupRes message. It allows deciding if the communication setup was successful;

- Ready to Charge Timer: Monitors the time from plug-in until reception of the first PowerDeliveryRes message. It allows deciding if EV's request for power from the SECC was successful.

The monitoring of the cable check is carried out by the EVCC using the V2G_EVCC_CableCheck_Timer. It is started when the PEV requests the EVSE to start the cable check, and ended when the EVSE has finished the cable check, or when the V2G_EVCC_CableCheck_Timer expires.

The monitoring of the pre-charge is carried out by the EVCC using the V2G_EVCC_PreCharge_Timer. It is started when the PEV starts the pre-charging by sending the first PreChargeReq message, and ended when the pre-charging has finished, indicated by the PEV determining that the EVSE output voltage, as measured inside the PEV, has sufficiently been adjusted to the PEV RESS voltage, or when the V2G_EVCC_PreCharge_Timer expires.

The timers are compared to predefined time values as decision criterion. The EVCC and the SECC distinguish between two types of criteria:

- Timeout: If the specified time is exceeded the related error handling is initiated;

- Performance time: If the specified time is exceeded the performance requirement is not fulfilled.

NOTE: While exceeding a timeout always causes an error handling, exceeding the specified performance time does not necessarily cause error handling. Depending on the system behavior (e.g., transmission time) no error may occur if the corresponding communication partner does not detect a timeout but the probability for causing a timeout is high.

5.6.2 Message Sequence and Performance Timing Definitions

Message timers, sequence timers, timeouts, and performance times are defined for the EVCC and SECC separately and summarized in Table 101. Timeouts and performance times are parameterized for messages separately to describe different processing times.

Table 102 defines the values for each V2G message type.

Table 101 - EVCC and SECC timers, timeouts, and performance times

Name	Type	Applicable for	
		EVCC	**SECC**
V2G_EVCC_Msg_Timer	Message timer in the EVCC.	x	
V2G_SECC_Msg_Timer	Message timer in the SECC.		x
V2G_EVCC_Sequence_Timer	Sequence timer in the EVCC.	x	
V2G_SECC_Sequence_Timer	Sequence timer in the SECC.		x
V2G_EVCC_Msg_Timeout(MessageType)	Timeout for the message timer. The value is defined depending on the parameter MessageType as defined in Table 8.	x	
V2G_SECC_Msg_Performance_Time(MessageType)	Performance time for the message timer. The value is defined depending on the parameter MessageType as defined in Table 8.		x
V2G_EVCC_Sequence_Performance_Time	Performance time for the sequence timer as defined in Table 8.	x	
V2G_SECC_Sequence_Timeout	Timeout for the sequence timer as defined in Table 8.		x

Table 102 - EVCC and SECC message timeouts and performance times

Name	MessageType	Value (seconds)
V2G_EVCC_Msg_Timeout(MessageType)	SupportedAppProtocolReq	2
	SessionSetupReq	2
	ServiceDiscoveryReq	2
	ServicePaymentSelectionReq	2
	ContractAuthenticationReq	2
	ChargeParameterDiscoveryReq	2
	PowerDeliveryReq	2
	CableCheckReq	2
	Pre-chargeReq	2
	CurrentDemand	0.25
	WeldingDetectionReq	2
	SessionStopReq	2
V2G_SECC_Msg_Performance_Time(MessageType)	SupportedAppProtocolRes	1.5
	SessionSetupRes	1.5
	ServiceDiscoveryRes	1.5
	ServicePaymentSelectionRes	1.5
	ContractAuthenticationRes	1.5
	ChargeParameterDiscoveryRes	1.5
	PowerDeliveryRes	1.5
	CableCheckRes	1.5
	Pre-chargeRes	1.5
	CurrentDemandRes	0.025
	WeldingDetectionRes	1.5
	SessionStopRes	1.5
V2G_EVCC_Sequence_Performance_Time	(all messages)	59
V2G_SECC_Sequence_Timeout	(all messages)	60

Figure 22 illustrates how the message timers, sequence timers, timeouts and performance times are applied in the EVCC and the SECC.

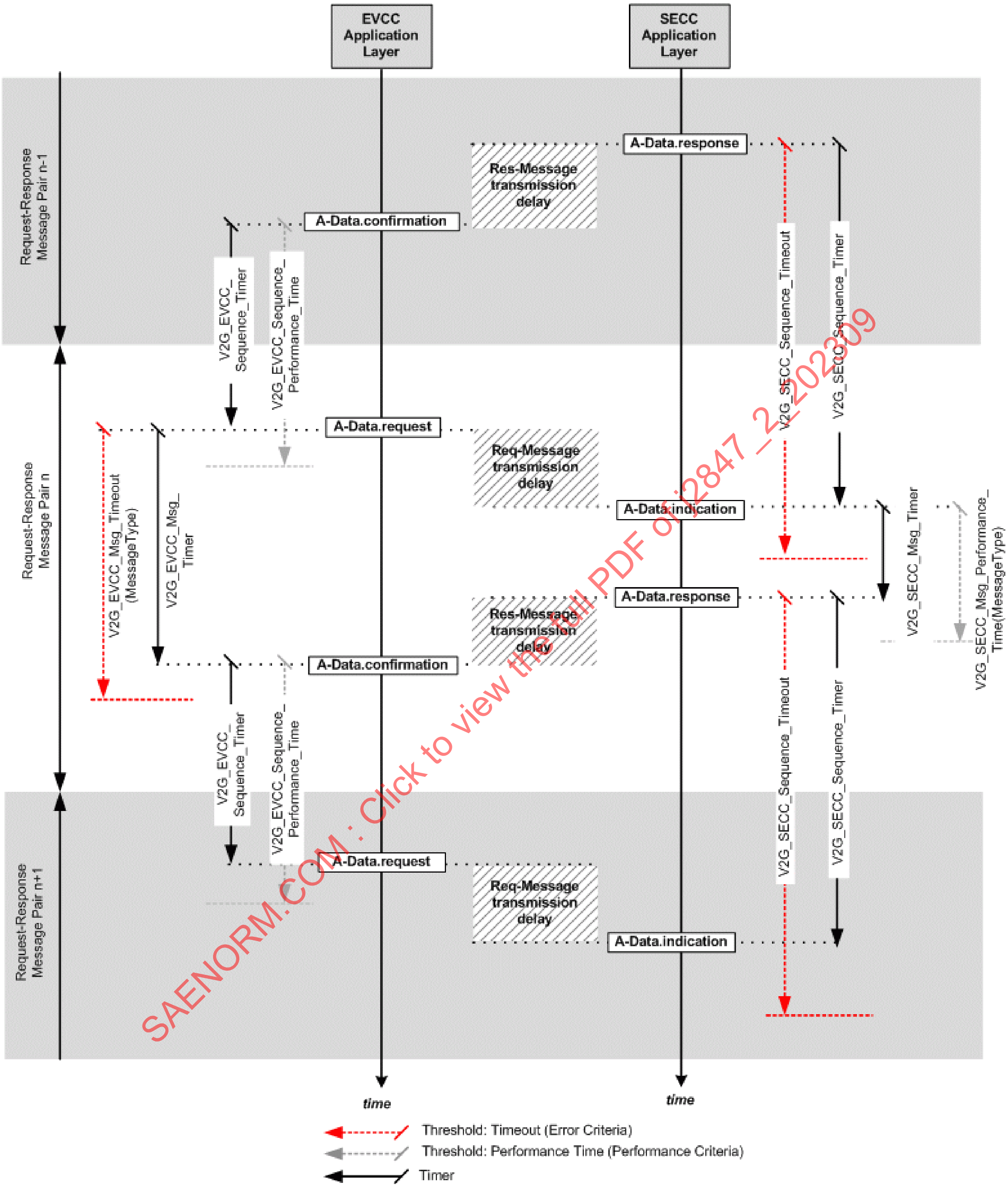


Figure 22 - Message sequence and performance timing

[V2G-DC-357] The EVCC shall implement an EVCC specific timeout supervision according to Table 1 that satisfy the values defined in Table 2.

NOTE: This EVCC should exhibit a temporal behavior with respect to the so-called “performance times” that satisfy the values defined in Table 2.

[V2G-DC-358] The SECC shall implement a SECC specific timeout supervision according to Table 1 that satisfy the values defined in Table 2.

NOTE: This SECC should exhibit a temporal behavior with respect to the so-called "performance times" that satisfy the values defined in Table 2.

5.6.3 EVCC Timing and Error Handling for Request-Response Message Pairs

[V2G-DC-359] When the EVCC sends a request message, it shall set the timeout V2G_EVCC_Msg_Timeout to the value defined in Table 2 for the respective message. It shall then reset and start the V2G_EVCC_Msg_Timer and start to continuously monitor the V2G_EVCC_Msg_Timer for reaching or exceeding V2G_EVCC_Msg_Timeout.

NOTE: In this document, sending a request message is described by A-DATA.request.

[V2G-DC-361] At any point in time in the V2G communication session while the EVCC monitors the V2G_EVCC_Msg_Timer, if V2G_EVCC_Msg_Timer is equal or larger than V2G_EVCC_Msg_Timeout, the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

NOTE: According to SAE J1772, if the SECC detects an unexpected CP State B, the SECC carries out, without any delay, an "EVSE initiated emergency shutdown," which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-362] When the EVCC receives a response message while V2G_EVCC_Msg_Timer is smaller than V2G_EVCC_Msg_Timeout, it shall stop the V2G_EVCC_Msg_Timer and end monitoring it.

NOTE: In this document, receiving a response message is described by A-DATA.confirmation.

5.6.4 SECC Timing and Error Handling for Response-Request Message Sequence

[V2G-DC-364] When the SECC sends a response message, it shall set the timeout V2G_SECC_Sequence_Timeout to the value defined in Table 2 for the respective message. It shall then reset and start the V2G_SECC_Sequence_Timer, and it shall start to continuously monitor the V2G_SECC_Sequence_Timer for reaching or exceeding V2G_SECC_Sequence_Timeout.

NOTE: In this document, sending a response message is described by A-DATA. response.

[V2G-DC-366] At any point in time in the V2G communication session while the SECC monitors the V2G_SECC_Sequence_Timer, if V2G_SECC_Sequence_Timer is equal or larger than V2G_SECC_Sequence_Timeout, the SECC shall:

- Without any delay, carry out an "EVSE-initiated emergency shutdown" as specified in SAE J1772, which includes turning off the CP oscillator, if it is turned on,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-116].

NOTE: According to SAE J1772, when the SECC carries out an "EVSE emergency shutdown," it also performs a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-367] When the SECC receives a request message while V2G_SECC_Sequence_Timer is smaller than V2G_SECC_Sequence_Timeout, it shall stop the V2G_SECC_Sequence_Timer and end monitoring it.

NOTE: In this document, receiving a request message is described by A-DATA.indication.

5.6.5 V2G Communication Session Timing Definitions

Table 3 shows timing parameters applicable to several phases of the V2G communication session as defined in this document. Table 4 defines the values for the related Performance Times and the Timeouts.

5.6.5.1 EVCC Timing and Error Handling for V2G Communication Session Setup Timeout.

[V2G-DC-369] When CP State B with 5% duty cycle is indicated at the beginning of a charging session, the EVCC shall set the timeout V2G_EVCC_CommunicationSetup_Timeout to the value defined in Table 4. It shall then reset and start the V2G_EVCC_CommunicationSetup_Timer and shall start to continuously monitor the V2G_EVCC_CommunicationSetup_Timer for reaching or exceeding V2G_EVCC_ CommunicationSetup_Timeout.

[V2G-DC-371] At any point in time in the V2G communication session while the EVCC monitors the V2G_EVCC_CommunicationSetup_Timer, if V2G_EVCC_CommunicationSetup_Timer is equal or larger than V2G_EVCC_CommunicationSetup_Timeout, the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session and
- Close the TCP connection according to [V2G-DC-107.

NOTE: According to SAE J1772, if the SECC detects an unexpected CP State B, the SECC carries out, without any delay, an “EVSE-initiated emergency shutdown,” which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-372] When waiting for a SessionSetupRes message according to the message sequence specified in 5.3.4.1.1, if the EVCC receives a SessionSetupRes message, it shall stop the V2G_EVCC_CommunicationSetup_Timer and end monitoring it.

NOTE: In this document, receiving the SessionSetupRes message is described by A-DATA.confirmation (SessionSetupRes).

5.6.5.2 EVCC Timing and Error Handling for Ready to Charge Timeout

[V2G-DC-373] When CP State B with 5% duty cycle is indicated at the beginning of a charging session, the EVCC shall set the timeout V2G_EVCC_ReadyToCharge_Timeout to the value defined in Table 4. It shall then reset and start the V2G_EVCC_ReadyToCharge_Timer, and shall start to continuously monitor the V2G_EVCC_ReadyToCharge_Timer for reaching or exceeding V2G_EVCC_ReadyToCharge_Timeout.

[V2G-DC-375] At any point in time in the V2G communication session while the EVCC monitors the V2G_EVCC_ReadyToCharge_Timer, if V2G_EVCC_ReadyToCharge_Timer is equal or larger than V2G_EVCC_ReadyToCharge_Timeout, the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

NOTE: According to SAE J1772, if the SECC detects an unexpected CP State B, the SECC carries out, without any delay, an “EVSE-initiated emergency shutdown,” which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-376] When waiting for a PowerDeliveryRes message according to the message sequence specified in 5.3.4.1, if the EVCC receives a PowerDeliveryRes message, it shall stop the V2G_EVCC_ReadyToCharge_Timer and end monitoring it.

NOTE: In this document, receiving the PowerDeliveryRes message is described by A_DATA.confirmation (PowerDeliveryRes).

5.6.5.3 EVCC Timing and Error Handling for Cable Check Timeout

[V2G-DC-377] When the EVCC sends the CableCheckReq message for the first time in a communication session, it shall set the timeout V2G_EVCC_CableCheck_Timeout to the value defined in Table 4. It shall then reset and start the V2G_EVCC_CableCheck_Timer, and shall start to continuously monitor the V2G_EVCC_CableCheck_Timer for reaching or exceeding V2G_EVCC_CableCheck_Timeout.

NOTE: In this document, sending a CableCheckReq message is described by A-DATA.request(CableCheckReq).

[V2G-DC-380] At any point in time in the V2G communication session while the EVCC monitors the V2G_EVCC_CableCheck_Timer, if V2G_EVCC_CableCheck_Timer is equal or larger than V2G_EVCC_CableCheck_Timeout, the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

NOTE: According to SAE J1772, if the SECC detects an unexpected CP State B, the SECC carries out, without any delay, an "EVSE-initiated emergency shutdown," which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-381] When waiting for a CableCheckRes message according to the message sequence specified in 5.3.4.1, if the EVCC receives a CableCheckRes message with parameter ResponseCode equal to "OK" and parameter EVSEProcessing equal to "Finished," the EVCC shall stop the V2G_EVCC_CableCheck_Timer and end monitoring it.

NOTE: In this document, receiving a CableCheckRes message is described by A-DATA.confirmation(CableCheckRes).

5.6.5.4 EVCC Timing and Error Handling for Pre-Charging Timeout

[V2G-DC-382] When the EVCC sends the PreChargeReq message for the first time in a communication session, it shall set the timeout V2G_EVCC_PreCharge_Timeout to the value defined in Table 4. It shall then reset and start the V2G_EVCC_PreCharge_Timer and shall start to continuously monitor the V2G_EVCC_PreCharge_Timer for reaching or exceeding V2G_EVCC_PreCharge_Timeout.

NOTE: In this document, sending a PreChargeReq message is described by A-DATA.request (PreChargeReq).

[V2G-DC-385] At any point in time in the V2G communication session while the EVCC monitors the V2G_EVCC_PreCharge_Timer, if V2G_EVCC_PreCharge_Timer is equal or larger than V2G_EVCC_PreCharge_Timeout, the EVCC shall:

- Without any delay, change to CP State B, if the EVCC is not in CP State B,
- Terminate the V2G communication session, and
- Close the TCP connection according to [V2G-DC-107].

NOTE: According to SAE J1772, if the SECC detects an unexpected CP State B, the SECC carries out, without any delay, an "EVSE-initiated emergency shutdown," which includes turning off the CP oscillator, if it is turned on, and a fast reduction of the output current. For details, please refer to SAE J1772.

[V2G-DC-386] When waiting for a PreChargeRes message, if the EVCC receives a PreChargeRes message and the EV determines that the EVSE output voltage, as measured inside the EV, has sufficiently been adjusted to the EV RESS voltage, the EVCC shall stop the V2G_EVCC_PreCharge_Timer and end monitoring it.

NOTE: In this document, receiving a PreChargeRes message is described by A-DATA.confirmation(PreChargeRes).

Table 103 - EVCC and SECC communication session timing parameters

Parameter Name	Definition	Implementation	
		EVCC	SECC
V2G_EVCC_CommunicationSetup_Timer	Communication setup timer in the EVCC.	X	
V2G_SECC_CommunicationSetup_Timer	Communication setup timer in the SECC.		X
V2G_EVCC_ReadyToCharge_Timer	Ready to charge timer in the EVCC.	X	
V2G_SECC_ReadyToCharge_Timer	Ready to charge timer in the SECC.		X
V2G_EVCC_CableCheck_Timer	Cable check timer in the EVCC.	X	
V2G_SECC_CableCheck_Timer	Cable check timer in the SECC.		X
V2G_EVCC_Precharge_Timer	Pre-charge timer in the EVCC.	X	
V2G_SECC_Precharge_Timer	Pre-charge timer in the SECC.		X
V2G_EVCC_CommunicationSetup_ Timeout	Timeout for the communication setup timer in the EVCC as defined in Table 4.	X	
V2G_SECC_CommunicationSetup_ Performance_Time	Performance time for the communication setup Timer in the SECC as defined in Table 4.		X
V2G_EVCC_ReadyToCharge_Timeout	Timeout for the ready-to-charge timer in the EVCC as defined in Table 4.	X	
V2G_SECC_ReadyToCharge_ Performance_Time	Performance time for the ready to charge timer in the SECC as defined in Table 4.		X
V2G_EVCC_CableCheck_Timeout	Timeout for the cable check timer in the EVCC as defined in Table 4.	X	
V2G_SECC_CableCheck_Performance_Time	Performance time for the cable check timer in the SECC as defined in Table 4.		X
V2G_EVCC_Precharge_Timeout	Timeout for the pre-charge timer in the EVCC as defined in Table 4.	X	
V2G_SECC_ Precharge_Performance_Time	Performance time for the pre-charge timer in the SECC as defined in Table 4.		X

[V2G-DC-644] The EVCC and SECC shall implement an EVCC specific timeout supervision according to Table 102 that satisfies the values defined in Table 103.

NOTE: The SECC should exhibit a temporal behavior with respect to the so-called “performance times” that satisfies the values defined in Table 104.

Table 104 - EVCC and SECC communication session timing parameter values

Parameter Name	Value (seconds)	Implementation	
		EVCC	SECC
V2G_SECC_ReadyToCharge_Performance_Time	148		X
V2G_EVCC_ReadyToCharge_Timeout	150	X	
V2G_SECC_CommunicationSetup_Performance_Time	18		X
V2G_EVCC_CommunicationSetup_Timeout	20	X	
V2G_SECC_CableCheck_Performance_Time	38		X
V2G_EVCC_CableCheck_Timeout	40	X	
V2G_SECC_Precharge_Performance_Time	5		X
V2G_EVCC_Precharge_Timeout	7	X	
V2G_SECC_CPState_Detection_Timeout	1.5		X
V2G_SECC_CPOscillator_Retain_Time	1.5		X

Figure 23 illustrates how some of the timing parameters are applied.

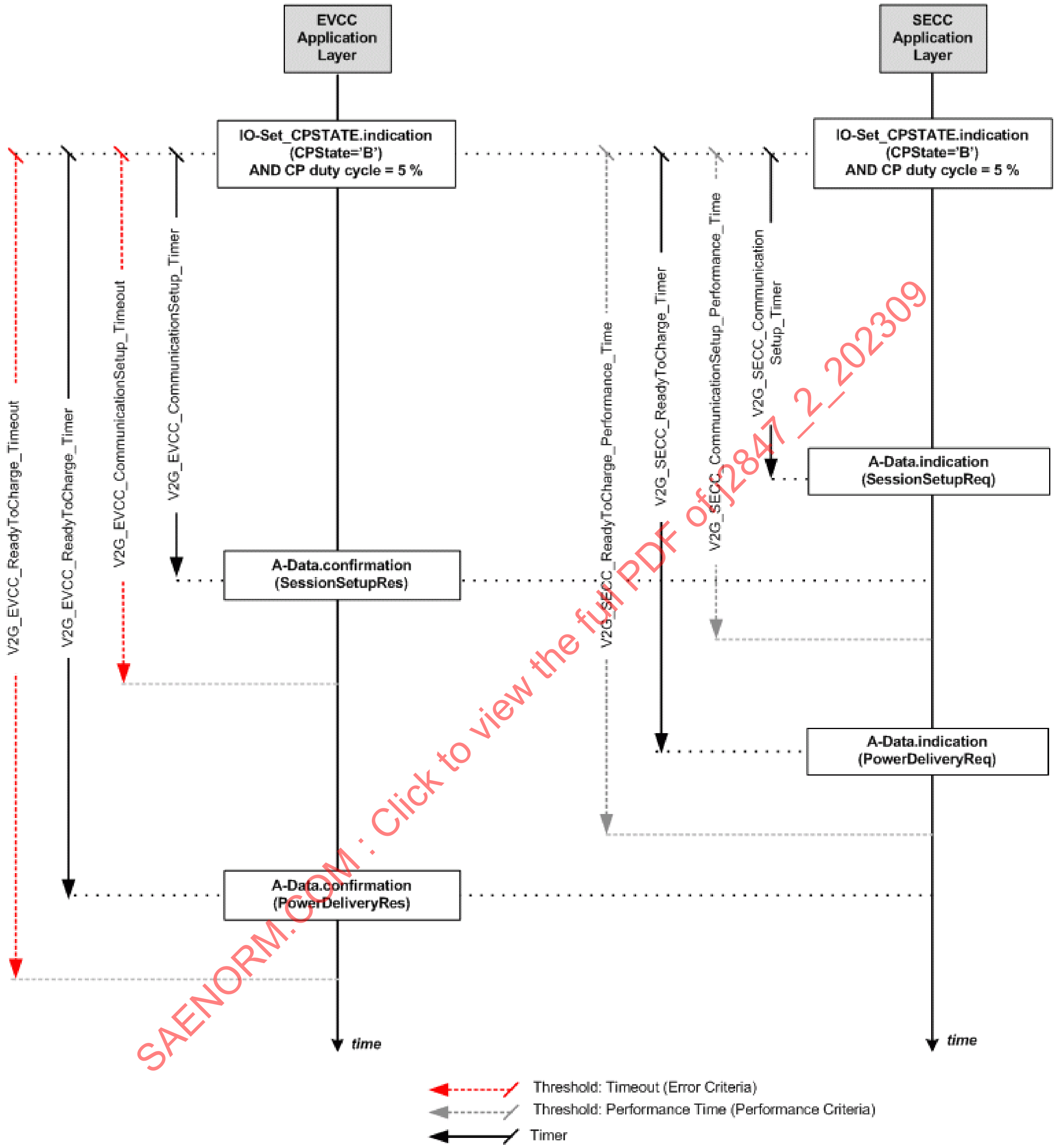


Figure 23 - V2G communication session timing

6. DC VEHICLE-TO-HOME (V2H) AND VEHICLE TO GRID (V2G) REQUIREMENTS

This section establishes the basis for DC bidirectional power transfer (BPT) using ISO 15118-2 with no additional changes to the schema shown in the other sections of this standard. Implementing V2H and V2G only changes the vehicle application layer software to provide a solution to the OEM for current design releases and also the capability to provide an update to legacy vehicles if desired.

BPT is intended for private applications such as homes but may also include fleet and multifamily dwellings, workplace, etc.

This is also Step 1 of a series of updates and only applies to the fundamental function for BPT for the DC EVSE and EV. Step 2 is the next update to this standard and intends to complete the DC V2G requirements to meet the IEEE 1547:2018 requirements and the home microgrid communication and controls that are only identified in 6.6.4 but not fully described in this update. The full DC V2G requirements are in UL 9741. The IEEE 1547 requirements for the EV is a subset of the AC V2G requirements since with AC, the inverter is onboard the vehicle and the full set of grid curves are processed by the EV, with DC V2G, these curves are only applied to the inverter in the DC EVSE and the EV requirements are less but some are still required. The DC V2G system is still being finalized and not ready to include more details at this time but expected to follow once this version is published.

The entire system requirements for AC V2G is defined in SAE J2836/3, SAE J2847/3, and SAE J3072, along with IEEE 2030.5:2018, IEEE 1547:2018, IEEE 1547.1:2020, and UL 1741 Supplement B. This, however, is still not complete and updates are still in process with UL 1741 SC and IEEE 2030.5 V2G-AC Profile Implementation Guide for SAE J3072 that will be published soon. SAE J2847/3 is also being updated to include the home requirements described in this section for the ATS, home balancing transformer. In addition to these, the Home Area Network requirements are described in SAE J2836/1 and SAE J2847/1 since the V2G and V2H process needs to balance the home loads with the inverter maximum power capabilities. The remaining item is then the home microgrid when the customer also includes PV or ESS as shown in 6.6.4 but not yet fully described. This is when the PV is present and potentially providing more energy than the home needss so the ESS and EV can actually charge instead of discharging, while one of these (EV or ESS) is performing the Grid Forming function for V2H. The PV could also allow the EV and/or ESS to charge during the V2G session where both the EV and ESS are grid following.

NOTE: The approach for negative values for current and power however in this document only applies to ISO 15118-2 since ISO 15118-20 has a variation to the schema that already includes BPT.

The summary of DC charging options are as follows and the EV sends these namespaces to the EVSE with a priority. The EVSE then responds with the one it can perform based on the priority from the EV:

- DIN 70121
- ISO 15118-2
- ISO 15118-20.

DC V2G/V2H options are:

- ISO 15118-2 (with this SAE standard using ServiceID and ServiceName) as identified above.
- ISO 15118-20
  - Light (described in this section)
  - Full standard

The EVSE is expected to implement all these if BPT capable. The EV needs to implement at least one of these.

6.1 Requirements:

The DC EVSE shall comply with state regulations such as Rule 21 in CA for DC V2G. Other state regulations are being formulated and expected to follow CA example or include portions of it. Rule 21, either directly or indirectly, refers to IEEE 1547:2018 and UL 9741 certification for the DC EVSE requirements.

The purpose of this Step 1 update is to identify the handshake required for negative signals for DC V2G or DC V2H.

- If the bidirectional DC EVSE requests DC V2H and EV is not capable of DC V2H, the communication will terminate. Switching to charging or DC V2G is not an option since the home does not have power. The DC V2G or charging session would start when the grid power is restored and the automatic transfer switch (ATS) signals the DC EVSE that grid power is present. This success or failure is described in 6.5.1 with the response code, unique for DC V2H for the EV to include in the diagnostics for the customer and vehicle service provider to properly identify why the session failed.
    - The customer has to intentially desire this DC V2H feature and is required to meet the UL and regulatory requirements for installation for all the home equipment. They would also be expected to insure their EV is also capable of this function and then test the system when installed and then periodically. The feature is also expected to be programmed to start automatically so if the power is lost and the EV is connected, DC V2H will start without intervention.
    - If the customer has a legacy vehicle not capable of this function they could also contact their vehicle service provider to inquire if an update is available to the vehicle application level software to include this function on that vehicle.
- If V2G is requested by the EVSE or EV and both the bidirectional DC EVSE or EV are not capable of DC V2G, the communication will also terminate. The response code is identified in = 6.7.1.1 that is unique for DC V2G to include in the diagnostics for the customer and vehicle service provider to properly identify why the session failed.
    - The act of V2G is intentional to prevent demand charge fees or reduce the higher energy cost during high load periods that may be applied from their utility program. If DC V2G fails, it is up to the customer to determine if charging is still desired for that session and needs to initiate the restart of the system in charging mode. This should not be an automatic transfer from DC V2G failing to charging.
    - V2G also loses at least 10% energy for the session since the inverter is assumed to be 95% efficient and the loss from discharging is then 5% along with the loss of recharging of the other 5%. The value to the customer to initiate this from the EV is intentional and needs to be offset by value provided for performing this function or would not be used. Additional loads such as battery conditioning and other auxiliaries add to this energy loss.

This section includes the complete home system requirements for V2G and V2H. This includes options on pre-charging the DC EVSE for DC V2H if the home backup power does not provide this function.

IEEE 1547:2018 identifies that the DER (V2G) shall be supported by at least one of the protocols and additional protocols may be allowed under mutual agreement between area EPS operator and DER operator. These are IEEE 2030.5 (SEP2), IEEE 1815 (DNP3), and SunSpec Modbus.

6.2 Security

Security shall use SAE J2931/7, Table 3 for the high-level requirements when a PEV connects to the EVSE. Specific details for implementation are described in IEEE 2030.5-2018 Section 6 that provides information on the TLS version, cipher-suites, and PKI structure.

6.3 Switching Between V2H and V2G

There is no means to switch between V2H and V2G or vise versa. A restart by toggeling the SAE J1772 pilot PWM (or replug) is required.

Step 3 in Figure 24 shows the sequence to start the V2H session. Step 4 shows the grid power returning and shows the sequence to restart a charging or V2G session.

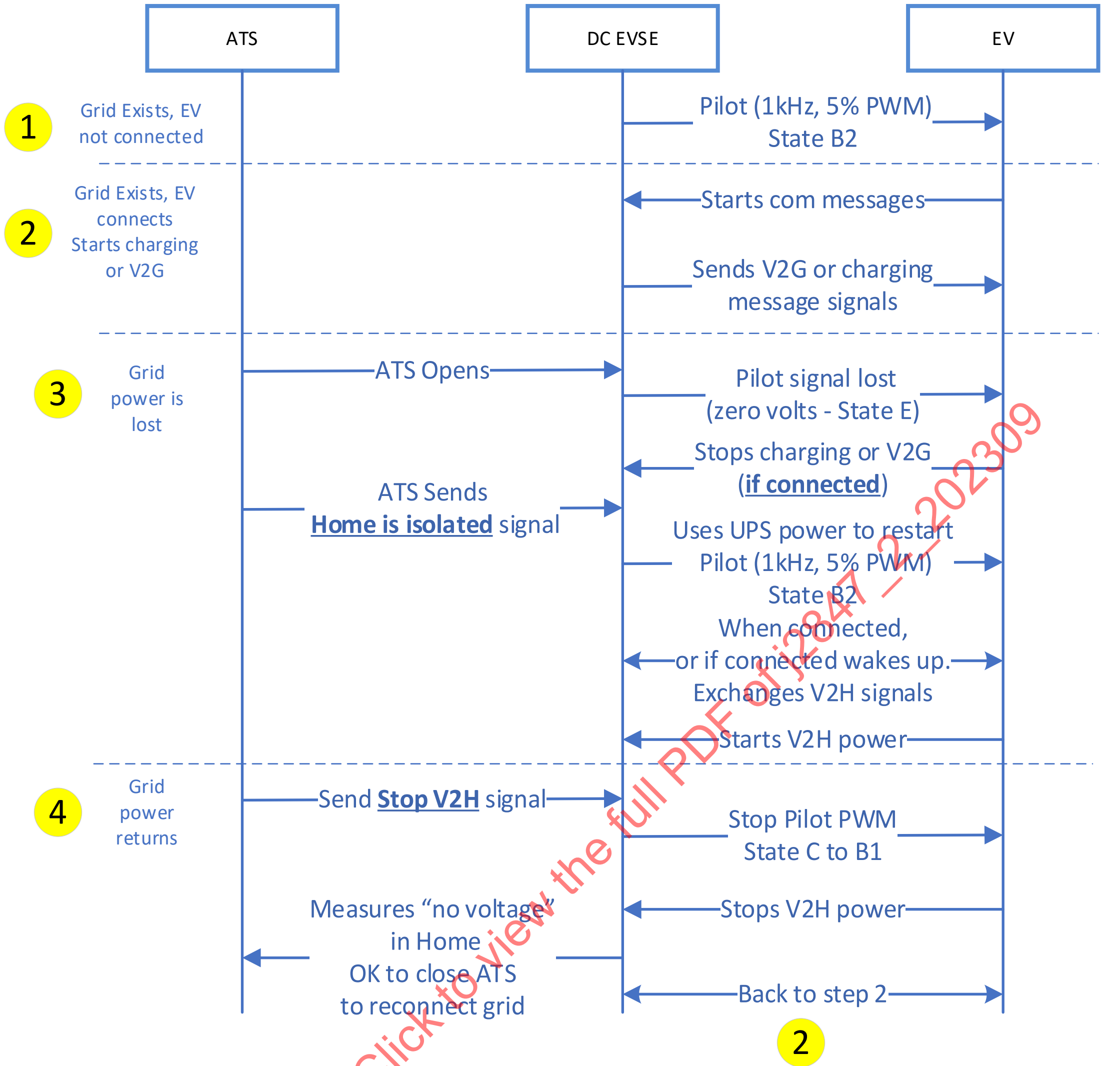


Figure 24 - V2H and V2G sequence diagram

6.4 DC Vehicle-to-Home Overview

DC vehicle-to-home (V2H) is always initiated by the site through the DC EVSE to the vehicle. This is to assure that the home grid power is not present and the home has been islanded prior to the vehicle starting a V2H session.

The home is required to include an islanded device for example an ATS capable of detecting grid outages and islanded the home's critical loads from the grid and when the home is islanded, sends a signal to the DC EVSE for a vehicle to start providing power to the home.

Backup power using a cold start battery or UPS is required to power the controls in the ATS and in the DC EVSE. An option for the home is a common UPS or separate units. The home may also include a stationary ESS that can also provide power to the home and this device would also serve as the UPS.

The DC EVSE provides the pilot signal per SAE J1772 and when a vehicle connects, changes from State A (12 V) to State B (PWM) with a 1kHz frequency and a 5% PWM rate, indicating high-level communication (HLC) is required.

A home balancing transformer is also required to transform the inverter's 240 VAC single phase output in a 120 VAC split phase output and/or to balance the two 120 V segments of the 240 VAC system vehicle HV battery interfaces.

- The vehicles that include an 800 VDC system also include a boost inverter to be able to charge at legacy DC EVSEs that are generally limited to 50 kW and 500 VDC. This would be a pass thru if connected to a 920 VDC EVSE.

- 800 VDC vehicle systems also need this inverter to be bidirectional (buck/boost) if connected to a 20 kW or less DC EVSE for V2G or V2H that is limited to 500 VDC.

Figure 25 shows the boundary of the systems. Figure 26 shows the system schematic.

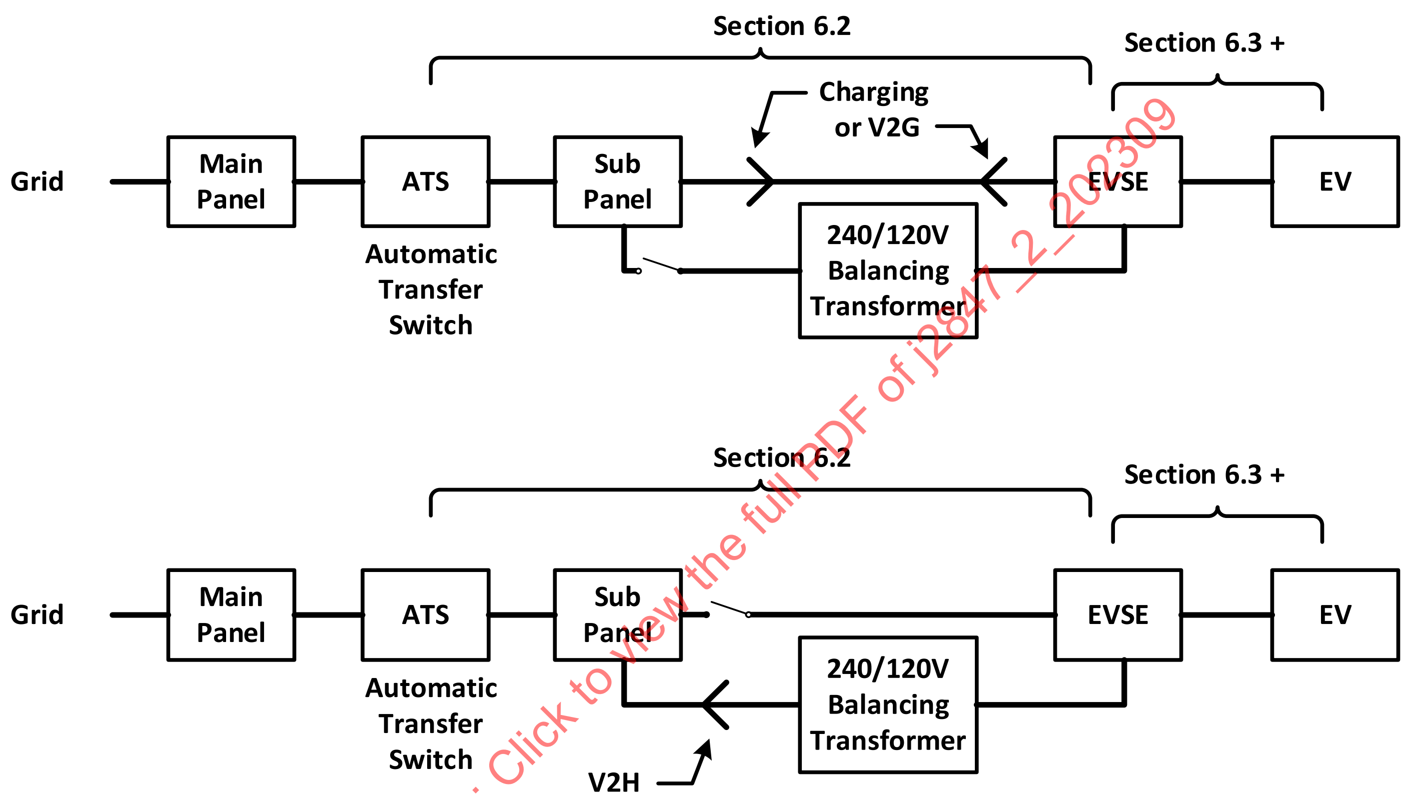


Figure 25 - Charging/V2G/V2H system boundary

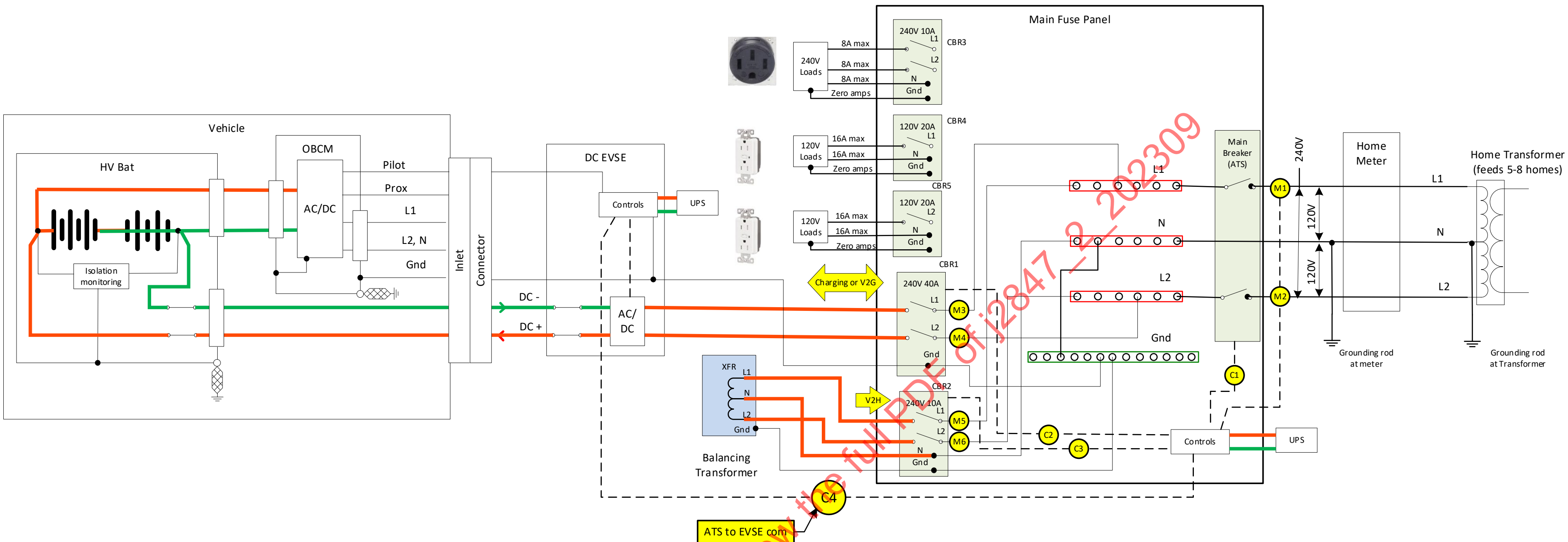


Figure 26 - System schematic

Controls and monitoring summary:

Table 105 - Controls and monitoring summary

Grid	Function	Component	Position	Control	Monitor
Yes	Charging or V2G	Main breaker (ATS)	Closed	C1	
		CBR1	Closed	C2	
		CBR2	Open	C3	
Goes out	V2H	Main breaker (ATS)	Open	C1	M1, M2
		CBR1	Open	C2	
		CBR2	Closed	C3	
Returns	Stop V2H	Main breaker (ATS)	Open	C1	M1, M2
		CBR1	Closed	C2	M3, M4
		CBR2	Open	C3	M4, M5
Yes	Restart charging or V2G	Main breaker (ATS)	Closed	C1	
		CBR1	Closed	C2	
		CBR2	Open	C3	

6.5 Communications Summary

The pilot signal generated in the EVSE is the same as for charging and described in SAE J1772.

- State A is when the vehicle is not connected.
- The pilot changes to State B1 (9V, no PWM) when the vehicle connects and the EVSE starts the PWM at 1kHz and 5% PWM (State B2) to start the digital communication between the vehicle and EVSE.

The ATS shall signal the DC EVSE that the home is islanded and V2H can be initiated. The EVSE can then initiate negative signals to trigger the vehicle to discharge as noted in 6.2.

- A communication cable is required between the ATS and DC EVSE and/or stationary storage.
- A RS 485 cable can be used to support bidirectionnal communication between the ATS and DC EVSE

The communication layers presented in Figure 27 and described below are used to implement communication betweem the ATS and DC EVSE over a RS 485 cable.

Protobuf
Transport
COBS
UART

Figure 27 - EVSE-ATS communication layers over UARTs

- Protobuf: Provides serialization and deserialization of messages
- Transport layer: Provides ACK/NAK/replay functionality. Prepends a 1-byte header to each frame, with the following fields:
  - 2 bits: Protocol version number.
  - 3 bits: 0 - Request or event (unsolicited), 1 - response, 2 - ack, 3 - nack, 4 - unreliable data (message for which ack/nack and sequence numbering is ignored). A nack indicates the reception of a message known to be bad and triggers a retransmit, starting after the last know good message.
  - 3 bits: Sequence number. Sequence number of the message, Sequence number of the ack'ed message, or sequence number of the last known good message (in the case of a NAK).
- COBS: Provides message delineation over streams. A trailing CRC-32 is appended to the frame before the cobs encoding step in the Tx direction (and verified in Rx) with the following markers:
  - 0x00: start marker.
  - 0xff: 254 bytes jump.
- UART: HW interface for RS-485.

Communication should be implemented using the following interlayer primitives and message primitives.

- Interlayer communication primitives:
  - Between protobuf and transport layer:
    - From protobuf to transport layer: "Transmit(msgType, message)."
    - From transport layer to protobuf: "Receive(msgType, message)."
    - Where msgType is of type of event, request, reply or unreliable.
  - Between transport layer and COBS:
    - From transport layer to COBS: "submit frame."
    - From COBS to transport layer: "receive frame" without any parameter.

- Message primitives

  EVSE-ATS messages are blocks of variable-sized, frame-based, binary data. They are encoded in protobuf version 3 format. Note: the following convention allows for the communication of data linked to additionnal/optional features that may be included in some ATS models (e.g., current sensor).

```
syntax = "proto3";
enum AcLineState {
  ON_GRID = 0;
  OFF_GRID = 1;
  READY_FOR_ON_GRID = 2; // Meets all conditions to go ongrid - waiting for a set_state request
}
enum AcLineBoardType {
  UNKNOWN = 0;
  HOME_CURRENT_SENSOR = 1;
  AUTOMATIC_TRANSFER_SWITCH = 2;
}
message AcLineGetVersionRequest { }
message AcLineGetVersionResponse {
  int32 majorNo = 1;
  int32 minorNo = 2;
  int32 patchNo = 3;
  int32 buildNo = 4;
  AcLineBoardType board_type = 5;
  bytes revId = 6;
}
message AcLineErrors {
  bool acPresenceError = 1;
  bool acFrequencyError = 2;
  bool acRmsError = 3;
  bool homeRelayError = 4;
  bool j1772RelayError = 5;
}
message AcLineReadings {
  float l1_current = 1;
  float l2_current = 2;
  uint32 ac_voltage = 3;
  float temperature = 4;
  float ac_frequency = 5;
  bool is_ac_present = 6;
  repeated bool relay_closed = 7;
  AcLineErrors errors = 8;
  AcLineState grid_state = 9;
  float phase_offset = 10;
}
message AcLineResponses {
  AcLineGetVersionResponse get_version = 1;
}
message AcLineSetStateRequest {
  AcLineState state = 1;
}
message AcLineSetConfigRequest {
  uint32 on_grid_delay = 1;
}
message AcLineResetRequest { }
message AcLineMessage {
  one of msg {
    AcLineGetVersionRequest get_version = 1;
    AcLineResponses rsp = 2;
    AcLineReadings data = 3;
    AcLineSetStateRequest set_state = 4;
    AcLineSetConfigRequest set_config = 5;
    AcLineResetRequest reset = 6;
  }
}
```

- Required Signals

The ATS should regularly send (without necessarily receiving a request from the EVSE) “AcLineMessage.msg.data” messages. This must be used to allow the EVSE to get the following information as well as to send the following command:

- Home system is capable of V2H -> if DC EVSE receives messages regularly and without error, it knows that it is connected to a properly functioning ATS. By sending an AcLineGetVersion, the DC EVSE can also confirm that it is connected to a compatible ATS. The field grid_state==ON_GRID, indicates that “grid is powering the home and that the DC EVSE can start an EV charging or V2G session (and that it cannot initiate a V2H session).

- ATS has islanded the home -> grid_state==OFF_GRID.

- Grid power has returned and V2H session can stop -> grid_state==READY_FOR_ON_GRID.

- EVSE commands to the ATS to reconnect the home to the grid -> AcLineMessage.set_state.state==ON_GRID.

    - Test signals: Test the system to make sure it functions when needed.

        - The EVSE and/or ATS can include activation tests using messages defined above to verify that command signals are properly exchanged between EVSE and ATS. This could also be at an automatic cycle without customer intervention. This is to test the home system and may or may not include the EV in this system test.

    - Items to consider for additional signals:

        - Customer desires to stop V2H.

        - Presses S3 on EVSE connector changes from State C to State B, same as stopping charging session.

        - Presses stop button on EVSE.

    NOTE: ATS continues to monitor grid and home voltage and grid voltage returns, connects to grid as long as home voltage is still zero.

    - Home has ESS and it does grid forming (voltage source), EV then needs to do grid following (current source).

        - The ATS signal needs to be directed to the unit expected to perform the grid forming function. If this is the ESE, the DC EVSE should also receive a signal to inform it of the house islanding status and the presence of another grid forming inverter to allow it to manage EV charging or discharging functions accordingly. For example, the EV may not be able to charge, depending on home loads and ESS power that requires additional coordination signals.

    - Solar energy is present and ESS and EV may be charging versus discharging.

6.6 Pairing the EV and EVSE

Private EVSE installations that are not in a secure location may require a pairing between the EVSE and the customers or vehicles using these. This is a requirement for charging and discharging. The EVCC ID and EVSE ID signals in the SessionSetup message requires unique signals to be exchanged and authorize the session if the site desires to restrict customers or vehicles that are not allowed to use the EVSE as shown in Figure 28.

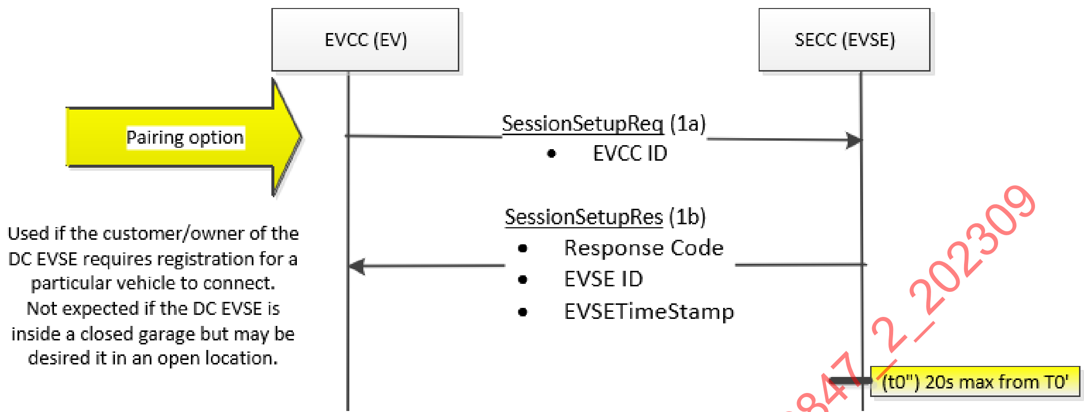


Figure 28 - Pairing signals

6.7 Service Negotiation for V2H

During the service negotiation phase, the EVSE will offer the V2H service to the EV. The EV will then select this service, to confirm that it fulfills this specification and is aware of the deviations from ISO 15118-2.

To achieve the aforementioned, the EVSE includes an additional service in the ServiceDiscoveryRes. This service will have a ServiceID equal to *28472*, ServiceName equal to "*SAE J2847/2 V2H*," ServiceCategory set to *OtherCustom* and FreeService set to *true*. An example of such a message in Table 106:

Table 106 - Service negotiation for V2H

ServiceID	ServiceName	ServiceCategory	Description
0			Reserved by ISO/IEC.
1	AC_DC_Charging	EVCharging	All charging services as defined by SupprtedEnergyTransferMode in ISO 15118-2, section 8.5.2.3.
2	Certificate	ContractCertificate	Service allowing to update or install Contract Certificates.
3	InternetAccess	Internet	Service for standard prococols like HRRP, HRRPs, FTP, etc.
4	UseCaseInformation	EVSEInformation	Service enabling the exchange of use case specific information about the EVSE.
28472	SAE J2847/2 V2H	OtherCustom	DC Vehicle-to-Home - V2H (EVSE inverter is grid forming).
28473	SAE J2847/2 V2G	OtherCustom	DC Vehicle-to-Grid - V2G (EVSE inverter is grid following).

```xml
<?xml version="1.0" encoding="UTF-8"?>
<V2G_Message xmlns="urn:iso:15118:2:2013:MsgDef" xmlns:v2gci_h="urn:iso:15118:2:2013:MsgHeader"
xmlns:v2gci_b="urn:iso:15118:2:2013:MsgBody" xmlns:v2gci_dt="urn:iso:15118:2:2013:MsgDataTypes"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:iso:15118:2:2013:MsgDef">
  <Header>
    <v2gci_h:SessionID>AABBCCDDEEFF7788</v2gci_h:SessionID>
  </Header>
  <Body>
    <v2gci_b:ServiceDiscoveryRes>
      <v2gci_b:ResponseCode>OK</v2gci_b:ResponseCode>
      <v2gci_b:PaymentOptionList>
        <v2gci_dt:PaymentOption>ExternalPayment</v2gci_dt:PaymentOption>
      </v2gci_b:PaymentOptionList>
      <v2gci_b:ChargeService>
        <v2gci_dt:ServiceID>1</v2gci_dt:ServiceID>
        <v2gci_dt:ServiceCategory>EVCharging</v2gci_dt:ServiceCategory>
        <v2gci_dt:FreeService>false</v2gci_dt:FreeService>
        <v2gci_dt:SupportedEnergyTransferMode>
          <v2gci_dt:EnergyTransferMode>DC_extended</v2gci_dt:EnergyTransferMode>
        </v2gci_dt:SupportedEnergyTransferMode>
      </v2gci_b:ChargeService>
      <v2gci_b:ServiceList>
        <v2gci_dt:Service>
          <v2gci_dt:ServiceID>28472</v2gci_dt:ServiceID>
          <v2gci_dt:ServiceName>SAE J2847/2 V2H</v2gci_dt:ServiceName>
          <v2gci_dt:ServiceCategory>OtherCustom</v2gci_dt:ServiceCategory>
          <v2gci_dt:FreeService>true</v2gci_dt:FreeService>
        </v2gci_dt:Service>
      </v2gci_b:ServiceList>
    </v2gci_b:ServiceDiscoveryRes>
  </Body>
</V2G_Message>
```

When receiving such a ServiceDiscoveryRes, the EV will select this service by including it in its PaymentServiceSelectionReq. An example of such a message is shown below:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<V2G_Message xmlns="urn:iso:15118:2:2013:MsgDef" xmlns:v2gci_h="urn:iso:15118:2:2013:MsgHeader"
xmlns:v2gci_b="urn:iso:15118:2:2013:MsgBody" xmlns:v2gci_dt="urn:iso:15118:2:2013:MsgDataTypes"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:iso:15118:2:2013:MsgDef">
  <Header>
    <v2gci_h:SessionID>AABBCCDDEEFF7788</v2gci_h:SessionID>
  </Header>
  <Body>
    <v2gci_b:PaymentServiceSelectionReq>
      <v2gci_b:SelectedPaymentOption>ExternalPayment</v2gci_b:SelectedPaymentOption>
      <v2gci_b:SelectedServiceList>
        <v2gci_dt:SelectedService>
          <v2gci_dt:ServiceID>1</v2gci_dt:ServiceID>
        </v2gci_dt:SelectedService>
        <v2gci_dt:SelectedService>
          <v2gci_dt:ServiceID>28472</v2gci_dt:ServiceID>
        </v2gci_dt:SelectedService>
      </v2gci_b:SelectedServiceList>
    </v2gci_b:PaymentServiceSelectionReq>
  </Body>
</V2G_Message>
```

6.8 Signal Variations for V2H (versus Charging or V2G)

The communication for V2H follows the same stages, messages and signals in Sections 4 and 5 of this document.

- The vehicle first sends the request message and then the DC EVSE sends the corresponding response message.

- The ChargeParameterDiscovery request message is sent from the vehicle the same as Charging with no changes to signals or values.

- The DC EVSE ChargeParameterDiscovery response message however; has signal for (1) EVSE Maximum Current Limit, (2) EVSE Maximum Power Limit, and (3) EVSE Minimum Current Limit with negative values to trigger the vehicle that the home power is out, the home is isolated and V2H is requested instead of going into a charging session.

    - Since this message is not normally a cyclic message, the EVSE Processing signal also needs to be set to “ongoing” until the vehicle responds with the negative signals in the next request message.

- The vehicle next request message changes the values to negative for (1) EV Maximum Current Limit, and (2) EV Maximum Power Limit. The bulk SoC signal is also set to the minimum SoC at which the vehicle wants to stop discharging.

    - The DC EVSE acknowledges these negative signals as it continues with negative signals and changes EVSE Processing signal to “Finished” so the next vehicle message (CableCheckReq) can be sent.

6.8.1 DC V2H Success and Failure Conditions

- Success (match negative values between EV and EVSE signals) is achieved when the handshake identified above is met and both the EVSE and EV exchange negative signals and move to the CableCheck message.

- Failure (does not match negative values between EV and EVSE signals) is If the EV is not capable of processing the negative signal responses or sending the next negative signal request for V2H. The EV may have a fault causing this to not start.

    - The EVSE will terminate the communication and set the pilot PWM to State B1 (no PWM) within 5 seconds.

    - The EVSE also sets Response Code FAILED_WrongChargeParameter and the vehicle may then set a fault code corresponding, so the customer or service is informed on the resulting action.

    - Restart may occur when the EVSE restarts the pilot PWM to State B2 and a new communication session starts. The EVSE may only perform this three times if the grid power is still out as to not deplete the home backup power for its controls. The V2H session is not able to start and the EV needs to wait until the grid returns to charge.

    - When grid power is restored to the home, the EVSE shall start the pilot PWM and the vehicle can charge.

    - Note: When the customer installs a Bidirectional DC EVSE they would test their vehicle to insure it also is capable of processing DC V2H signals. If this BPT DC EVSE is already installed to their site, it is also expected they would test their EV Capable of BPT with this unit prior to requiring V2H service. This is the same as installing a home generator system. The customer always tests the system proir to a grid outage to insure interoperability.

This process is in Figures 29 and 30.

Bulk SOC is an Optional signal in charging. It shall be a Mandatory message in V2H and V2G since it is used to identify the SoC the EV will stop discharging.

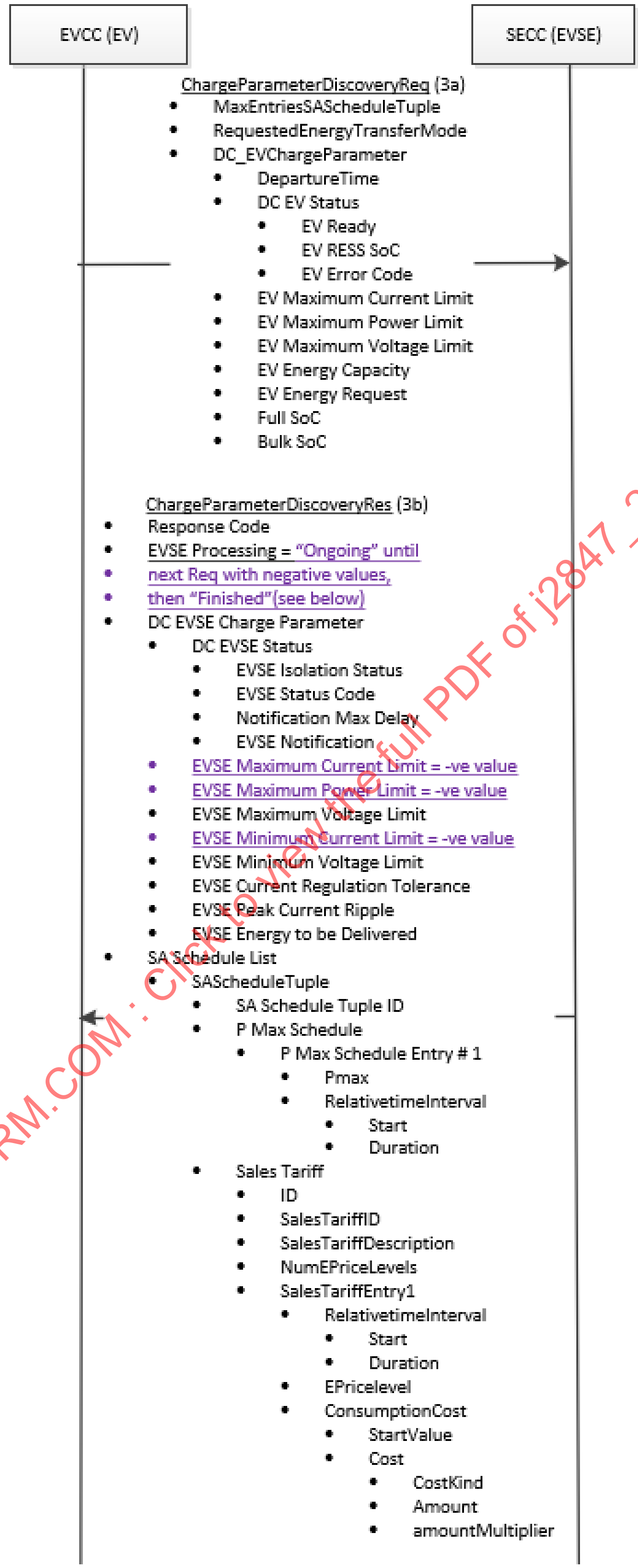


Figure 29 - Initial ChargeParameterDiscovery messages

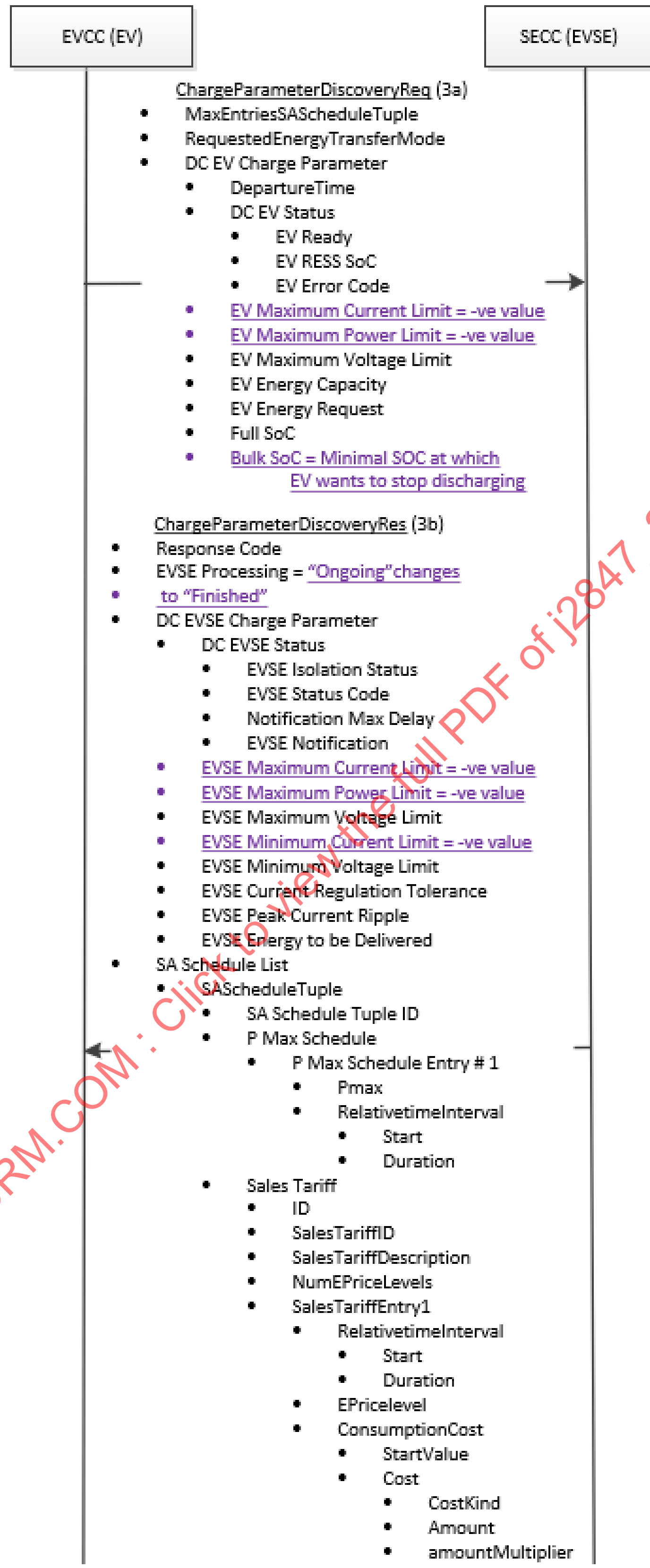
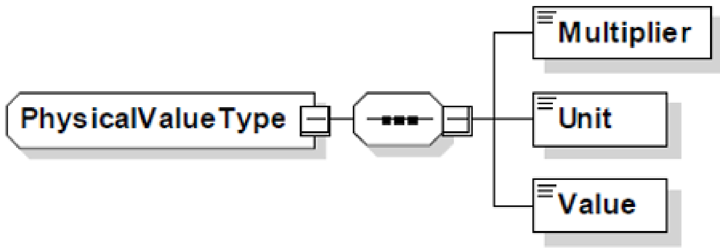


Figure 30 - Final ChargeParameterDiscovery messages

NOTE: If the home EVSE is not capable of V2H, then no power is applied to the EVSE and the pilot signal is 0 V or State E. No charging or discharging can occur without a valid pilot PWM (per SAE J1772 for charging).

The format for the negative values is in Figure 31.




```
EVSEMaximumCurrentLimit
   Multiplier: 1
   Unit: A
   Value: -2
   [EVSEMaximumCurrentLimit: -20]
```

Figure 31 - Negative format summary

Note that the multiplier number is positive while the value number is negative to obtain -20 A.

The multiplier is 10^x such that if the multiplier is:

- 3 = 1000
- 2 = 100
- 1 = 10
- 0 = 1
- -1 = 0.1
- -2 = 0.01
- -3 = 0.001

The combination of a positive multiplier and negative value provides the format for BPT.

6.9 Additional V2H items

6.9.1 Isolation Monitoring

Isolation monitoring does not change from charging. The DC EVSE performs this along with cable check and the vehicle stops isolation monitoring after CableCheckRes per SAE J1772 timing diagrams.

EVSE needs to complete cable check (HV or LV), then HV isolation monitoring prior to closing contactors.

6.9.2 Pre-Charge

- Precharge Option1 is the main or preferred method and Option 2 applies if Option 1 cannot be achieved and is identified by the EVSE setting the EVSEStatusCode value of EVSE_UtilityInterruptEvent as noted below.
    - Option 1: Home pre-charging for the DC EVSE from the UPS or stationary storage battery.
    - Option 2: The vehicle pre-charges the DC EVSE.

DC charging or DC V2G pre-charging schematic is in Figure 32. Switches are shown but are HV contactors or relays. This is a reference for the two V2H pre-charge options shown below.

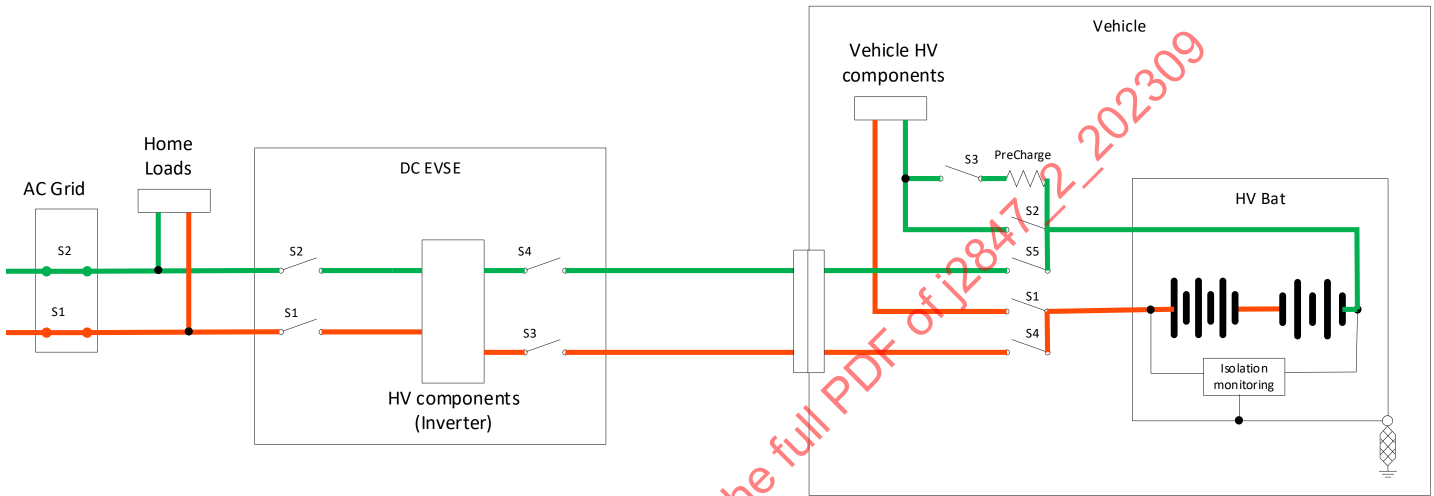


Figure 32 - Charging system schematic

Table 107 shows the contactor position steps for charging or V2G pre-charging.

Table 107 - Pre-charge steps for charging or V2G

<table>
<tr><td>Normal Charging or V2G</td><td></td><td></td><td colspan="4">DC EVSE</td><td></td><td colspan="6">EV</td></tr>
<tr><td>Action</td><td>Step</td><td>Msg</td><td>S1</td><td>S2</td><td>S3</td><td>S4</td><td>Comments</td><td>S1</td><td>S2</td><td>S3</td><td>S4</td><td>S5</td><td>Comments</td></tr>
<tr><td>Standby</td><td>0</td><td>0</td><td rowspan="3">O</td><td rowspan="3">O</td><td rowspan="3">O</td><td rowspan="3">O</td><td></td><td>O</td><td>O</td><td>O</td><td>O</td><td>O</td><td></td></tr>
<tr><td>Precharge EV</td><td>1</td><td>0</td><td></td><td>C</td><td>O</td><td>C</td><td>O</td><td>O</td><td>Customer action at EV</td></tr>
<tr><td>EV Precharge is complete</td><td>2</td><td>0</td><td></td><td rowspan="4">C</td><td rowspan="4">C</td><td rowspan="4">O</td><td rowspan="4">O</td><td rowspan="4">O</td><td>Close S2 then open S3</td></tr>
<tr><td>EVSE Performs HV Cable Check</td><td>3</td><td>4</td><td rowspan="4">C</td><td rowspan="4">C</td><td rowspan="4">C</td><td rowspan="4">C</td><td>DC voltage increases, then decreases</td><td></td></tr>
<tr><td>EVSE Cable Check is complete</td><td>4</td><td>4</td><td></td><td></td></tr>
<tr><td>EVSE Precharge to EV voltage</td><td>5</td><td>5</td><td>DC voltage increases</td><td></td></tr>
<tr><td>EVSE has matched EV voltage</td><td>6</td><td>5</td><td></td><td>C</td><td>C</td><td>O</td><td>C</td><td>C</td><td></td></tr>
</table>

6.9.2.1 Pre-Charge Option 1 Summary

The pre-charge Option 1 schematic (home pre-charging the DC EVSE) is in Figure 33.

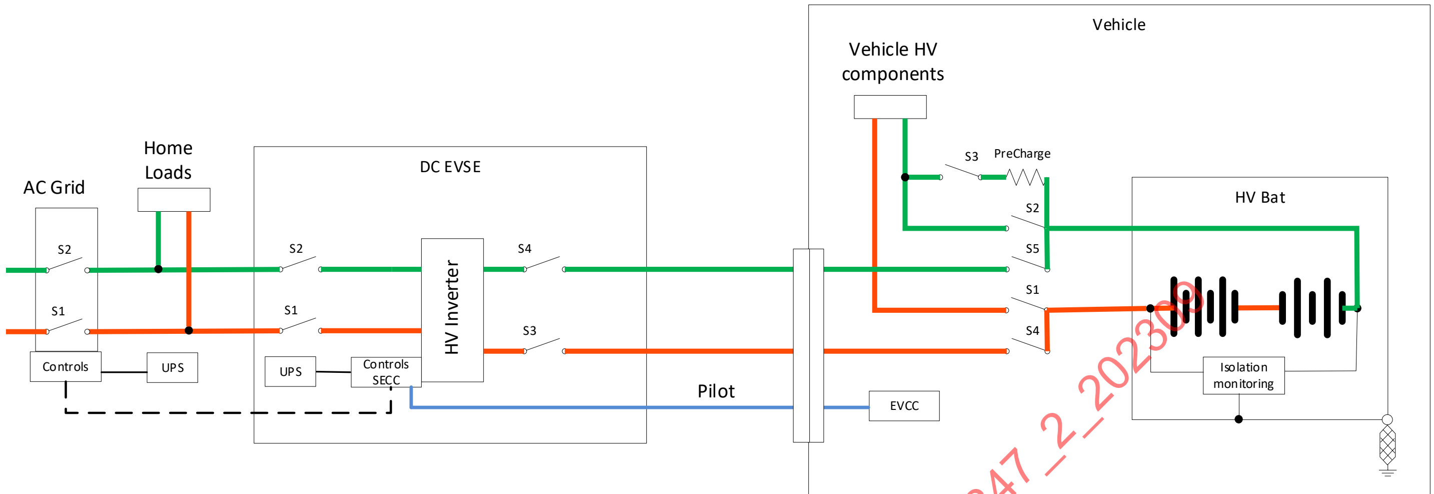


Figure 33 - Option 1 DC V2H system schematic—DC EVSE pre-charges from home

Table 108 shows the contactor position steps for Option 1 V2H pre-charging.

Table 108 - Option 1 pre-charge steps for DC V2H

V2H - Option 1 - Home Precharging EVSE			DC EVSE					EV					
Action	Step	Msg	S1	S2	S3	S4	Comments	S1	S2	S3	S4	S5	Comments
Standby	0	0						O	O	O			
Precharge EV	1	0	O	O	O	O		C		C			Customer action at EV
EV Precharge is complete	2	0											Close S2 then open S3
EVSE Performs HV Cable Check	3	4					DC voltage increases, then decreases				O	O	
EVSE Cable Check is complete	4	4											
EVSE Precharge to EV voltage	5	5	C	C	C	C	DC voltage increases	C	C	O			
EVSE has matched EV voltage	6	5									C	C	
Power home	7	7											

- Messages are the same as charging.
  - EV closes contactors at t9 (between 5b (PrechargeRes) and 6a (PowerDeliveryReq)).
  - If the max voltage for the EV and EVSE do not match:
    - If EVSE is 500 VDC max and EV requests higher voltage, the EV reduces the voltage request to match the max EVSE voltage (EV has a buck/boost inverter) or the session stops.

6.9.2.2 Pre-Charge Option 2 Summary

The pre-charge Option 2 schematic (vehicle pre-charging the DC EVSE) is in Figure 34.

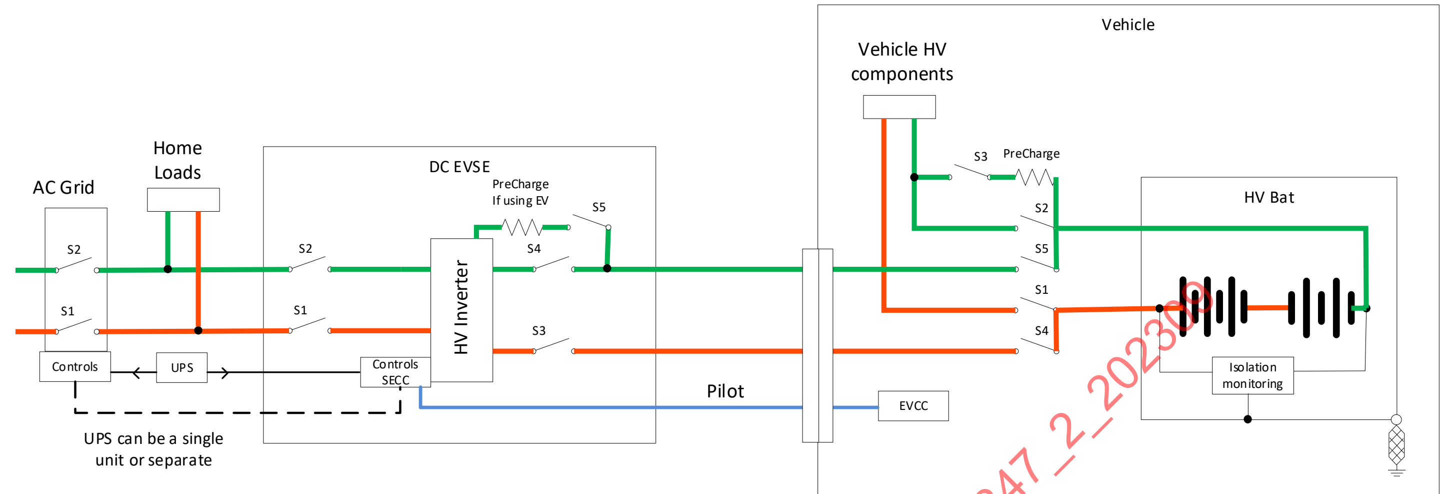


Figure 34 - Option 2 DC V2H system schematic

Table 109 shows the contactor position steps for Option 2 V2H pre-charging.

The DC EVSE is capable of 920 VDC, it needs to match requirements based on a 400 V or 800 V EV.

Table 109 - Option 2 pre-charge steps for DC V2H

<table>
<tr><td colspan="3">V2H - Option 2 - EV Precharging EVSE</td><td colspan="5">DC EVSE</td><td></td><td colspan="6">EV</td></tr>
<tr><td>Action</td><td>Step</td><td>Msg</td><td>S1</td><td>S2</td><td>S3</td><td>S4</td><td>S5</td><td>Comments</td><td>S1</td><td>S2</td><td>S3</td><td>S4</td><td>S5</td><td>Comments</td></tr>
<tr><td>Standby</td><td>0</td><td>0</td><td rowspan="3">O</td><td rowspan="3">O</td><td rowspan="3">O</td><td rowspan="3">O</td><td rowspan="3">O</td><td></td><td>O</td><td>O</td><td>O</td><td rowspan="5">O</td><td rowspan="5">O</td><td></td></tr>
<tr><td>Precharge EV</td><td>1</td><td>0</td><td></td><td>C</td><td>O</td><td>C</td><td>Customer action at EV</td></tr>
<tr><td>EV Precharge is complete</td><td>2</td><td>0</td><td></td><td rowspan="6">C</td><td rowspan="6">C</td><td rowspan="6">O</td><td>Close S2 then open S3</td></tr>
<tr><td>EVSE Performs HV Cable Check</td><td>3</td><td>4</td><td rowspan="4">O</td><td rowspan="4">O</td><td>C</td><td>C</td><td>O</td><td>DC voltage increases, then decreases</td><td></td></tr>
<tr><td>EVSE Cable Check is complete</td><td>4</td><td>4</td><td>O</td><td>O</td><td>O</td><td></td><td></td></tr>
<tr><td>Precharge EVSE</td><td>5</td><td>6</td><td>C</td><td>O</td><td>C</td><td>DC voltage increases</td><td rowspan="3">C</td><td rowspan="3">C</td><td></td></tr>
<tr><td>EVSE has matched EV voltage</td><td>6</td><td>6</td><td rowspan="2">C</td><td rowspan="2">C</td><td rowspan="2">O</td><td>Close S4 then open S5</td><td></td></tr>
<tr><td>Power home</td><td>7</td><td>7</td><td>C</td><td>C</td><td></td><td></td></tr>
</table>

The communication steps are in Figure 35:

- CableCheck (message 4): no change from charging, EVSE closes contactors and completes CableCheck using the EVSE backup power source.

- Precharge (message 5): EV identifies EVTargetVoltage to EVSE (400 or 800V system)
    - EVTargetVoltage signal: EV sends value, same as charging
    - EVSEPresentVoltage signal: EVSE responds with zero voltage, letting the EV know it wants the EV to pre-charge the EVSE.
        - If EV target voltage exceeds max EVSE Present voltage, session stops (if the EV Target voltage exceeds the capability or the EVSE).

- ○ DC EVSE Status message, EVSE Status Code is set to EVSE_UtilityInterruptEvent (instead of EVSE_NotReady or EVSE_Ready). This is the signal for the EV and EVSE to exit the pre-charge message, the EV then closes contactors and send PowerDelivery message.

  NOTE: SAE J1772, Appendix F, states the EVSE must meet the EVTargetVoltage within 7 seconds or the vehicle should shutdown. This applies to DC charging, DC V2G and DC V2H when the home pre-charges the DC EVSE. It does not apply to this option of DC V2H where the EV pre-charges the EVSE. EVTargetVoltage stays at zero and the EVSE is pre-charged in the next message (PowerDelivery), not during the pre-charge message.

Table 110 - EVSE status code

EVSE Status Code	0	EVSE_NotReady
	1	EVSE_Ready
	2	EVSE_Shutdown
	3	EVSE_UtilityInterruptEvent
	4	EVSE_IsolationMonitoringActive
	5	EVSE_EmergencyShutdown
	6	EVSE_Malfunction
	7	Reserved 8-C (ISO only)

- EV closes contactors
- PowerDelivery (message 6) and maximum value:
  - ○ EV pre-charges DC EVSE.
    - DC EVSE then safely energizes DC bus from 0V with a maximum in rush current of 10 A (at 400 VDC) or 24 A (at 800 VDC).
  - ○ When the EVSE is pre-charged, it changes EVSEStatusCode from EVSE_UtilityInterruptEvent to EVSE_Ready.
- Energy Transfer stage, CurrentDemand (message 7):
  - ○ EV provides power to the home.

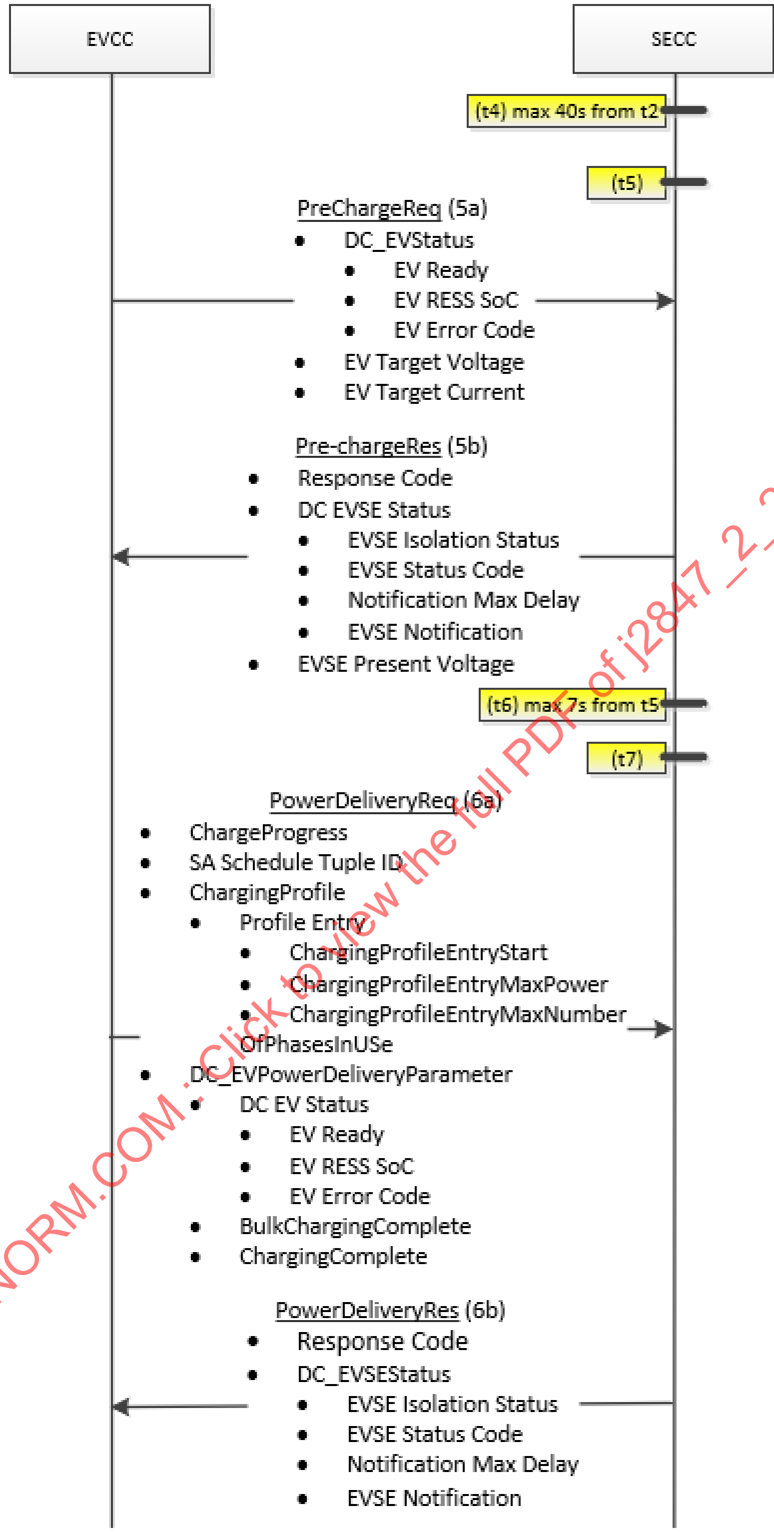


Figure 35 - Pre-charge and PowerDelivery messages

6.9.3 Backup Energy Source

The home requires a stable energy source device (uninterruptable power supply, UPS) to power the communications at the ATS and the DC EVSE. This can be a common unit or separate. If the home also includes a stationary storage system (HV battery) it is expected to also include a UPS to start it's inverter in the case of no grid power. This HV battery may then provide power to pre-charge the DC EVSE (Option 1) but the basic communication and controls is expected to be powered using the UPS, not the HV battery.

This device is expected to be sized to power the controls for a minimum of 48 hours, with a worst case of 3- to 7-day outage. It may include a design to go into standby mode if not used for a period where it could be manually restarted to provide sufficient power to start the communications to the ATS and DC EVSE to start the V2H power-up from a vehicle when connected.

6.9.3.1 Default Conditions

- DC V2H capable EV connects to the home without grid power and the EVSE is not capable of V2H (no ATS in home system).
    - The EVSE has no power for the pilot signal.
    - The EV detects State E (0 V) and if powered, will go to sleep until a valid pilot signal is received (State B2).

6.9.3.2 Controlled Shutdowns

- EVSE stops V2H because it is no longer required.
- The EV minimal SOC is reached.

DC EVSE Approach for item 1 shutdown, when grid returns or if item 2 occurs:

- Change EVSEStatusCode in Figure 36 from "EVSE_Ready" to "EVSE_Shutdown."
    - Signal is in CurrentDemandRes (7b) message, DC_EVSEStatus signal.

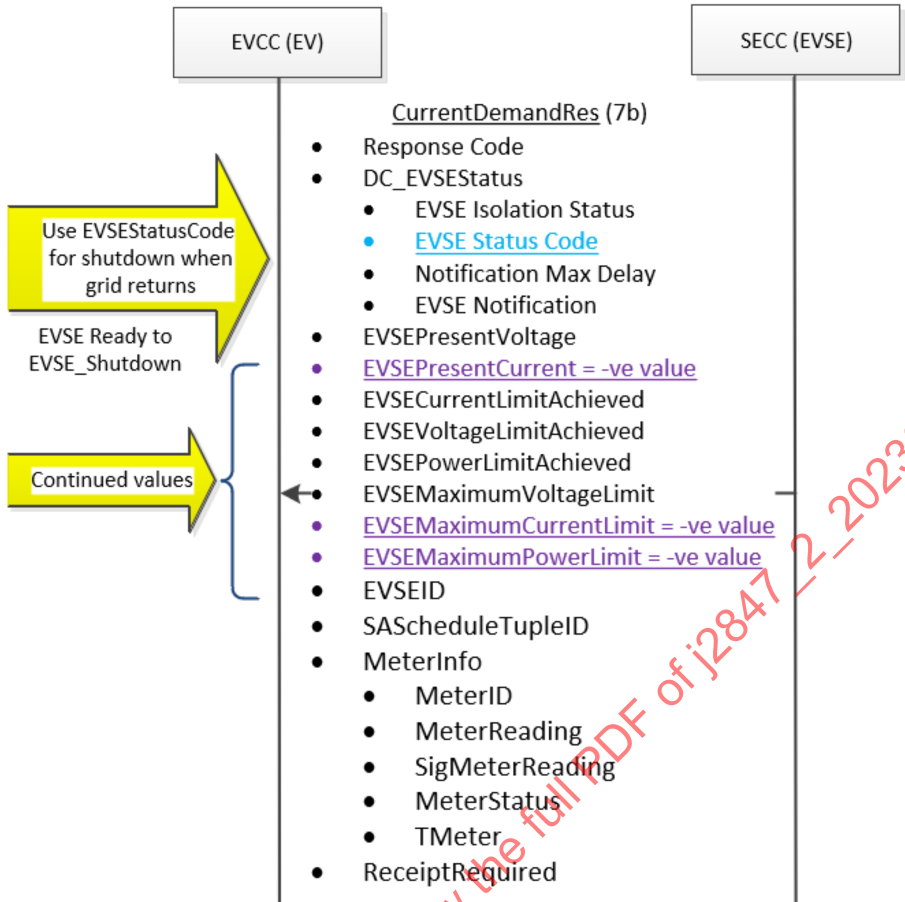


Figure 36 - CurrentDemand message

Table 111 - EVSEStatusCode values

EVSE Status Code	0	EVSE_NotReady
	1	EVSE_Ready
	2	EVSE_Shutdown
	3	EVSE_UtilityInterruptEvent
	4	EVSE_IsolationMonitoringActive
	5	EVSE_EmergencyShutdown
	6	EVSE_Malfunction
	7	Reserved 8-C (ISO only)

- Options when EVRESSSOC = Minimal SOC, after the EVSE has sent a SessionStopRes and if EVSEStatusCode was set to “EVSE_Shutdown” in CurrentDemandRes/PowerDeliveryRes.
  - EV initiated: EV opens S2, changing from pilot state C2 to B2.

    NOTE: The EVSE could always send a SessionStopRes message before the minimum SOC has been reached.
  - EVSE initiated: EVSE stops pilot PWM causing the EV to open S2.

6.9.3.3 Uncontrolled or Emergency Shutdown

- DC EVSE may cycle the power (to the EV) to reinitialize a normal charging or V2G session.
    - This opens the pilot (State E) and then restarts it for a new session (State A if vehicle is not connected, State B if vehicle is connected).

6.9.3.4 Minimal SOC Shutdown

Energy transfer stage:

- CurrentDemandReq (7a)
    - EVTargetCurrent = -ve value
    - EVMaximumCurrentLimit = -ve value
    - EVMaximumPowerLimit = -ve value
    - DC_EVStatus:
        - EVRESSSOC = Minimal SOC

(t10) reduce current req when V2H needs to stop.

- CurrentDemandRes (7b):
    - EVSEPresentCurrent = -ve value
    - EVSEMaximumCurrentLimit = -ve value
    - EVSEMaximumPowerLimit = -ve value
    - DC_EVSEStatus
        - EVSENotification = StopCharging

6.9.4 Shared V2H Resources

The home has options other than the vehicle providing power during a grid outage. Figure 37, 38, and 39 show some of the combinations.

- EV Only: Vehicle provides all the power to the home.
    - DC EVSE inverter is a voltage source (grid forming) and vehicle is discharging.
- Stationary storage only: Stationary storage provides all the power to the home.
    - Stationary storage inverter is a voltage source and is discharging.
- Solar only: Allowed solar inverter functions as a voltage source (if capable) and can throttle back (also if capable) if the home loads are less than solar is capable of providing. Control of load sheading is also required if solar power is less than home loads are present.
- EV and stationary storage: Need to determine the inverter that functions as a voltage source and inverter as a current source, may depend on SoC of each at start of session.

- EV and solar: DC EVSE inverter is voltage source.
- Stationary storage and solar: Stationary storage is voltage source.
- Define voltage source (grid forming) V2H vs current source (grid following) (V2G)

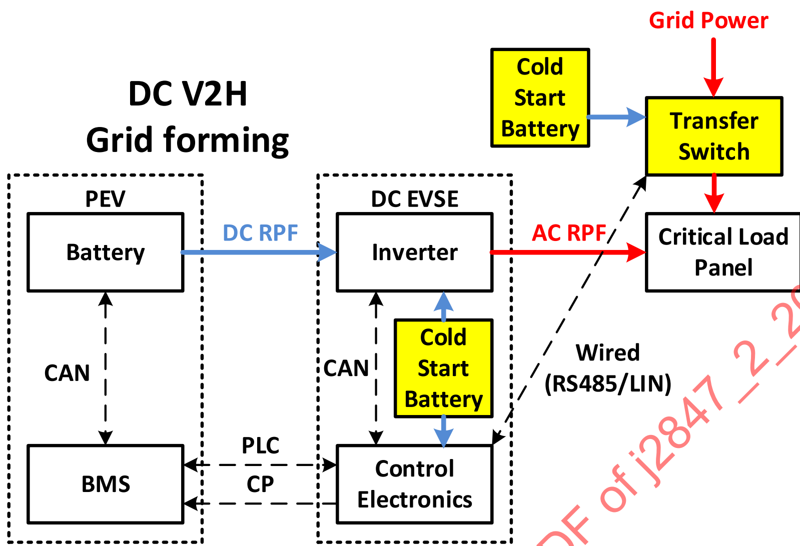


Figure 37 - DC EVSE

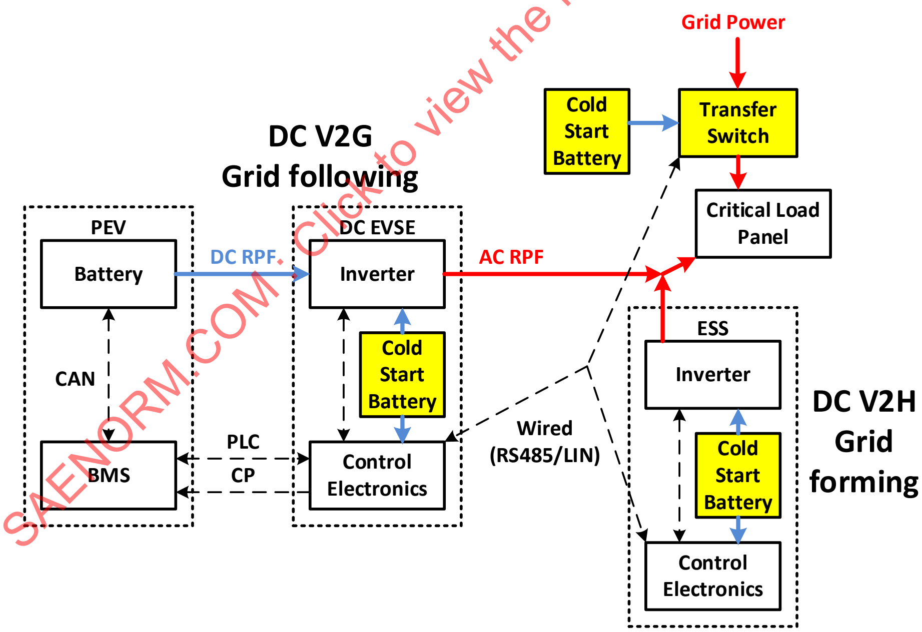


Figure 38 - (V2M) DC EVSE and ESS

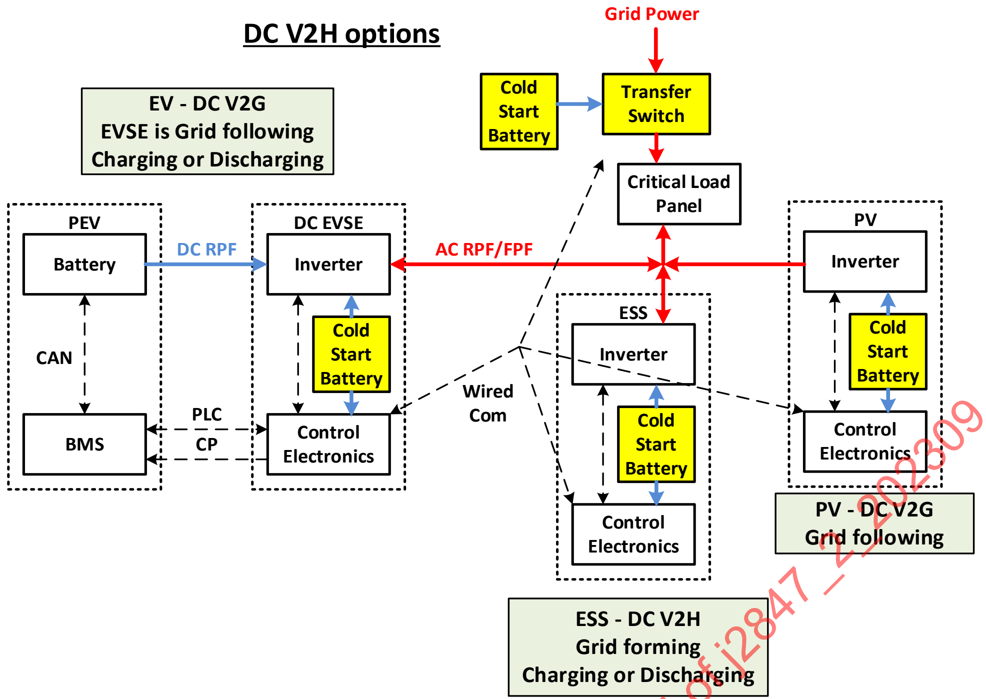


Figure 39 - (V2M)—DC EVSE (V2G—or charging), ESS (V2H), and PV

6.9.5 Manual Override

The home units require a manual override function to stop V2H.

- EV manual stop options:
    - Press S3 on the EVSE connector.
    - EV includes a control to open S2 (changing from State C to State B).
- EVSE manual stop options

6.10 V2G

V2G requires either grid power to the home or ESS (or another EV's onboard inverter or DC EVSE inverter) for the grid forming mode of operation.

V2G includes muliple variations, such as:

- Supplementing energy to the home when high price periods or high peak loads are experienced by the grid and home.
    - High price periods are described in SAE J2836/1 use cases U1, U3, or U4 for ToU, RTP, or CPP price programs.
    - These price programs are generally established and used during known high demand priods but the demand can also vary from these. SAE J2836/1 use case U2 is also used for demand response (DR) where the home or utility sends a signal to limit a peak demand usage.
    - V2G can be coupled with the price or DR signals to provide partial energy to the home (to reduce or eliminate a DR load value) or provide most or all of the home energy during high price periods, then allow the vehicle to recharge during low price periods.

- V2G can also provide export energy trhough the home to the grid, with advanced functions described in SAE J3072. This describes the functions to stabilize the grid and while SAE J3072 describes the vehicle onboard charger functions, the IEEE 1547 requirements apply to both the vehicle inverter or the one in the DC EVSE.

It should be noted that V2G function from the vehicle means generally a 10% energy loss since an inverter efficiency is around 5%. There is 5% loss during V2G, then the additional 5% loss to recharge the vehicle battery. The customer needs to realize this value by either opportunity savings (discharging during high price periods and recharging during low price periods) or direct compensation from the utility or aggregator.

6.10.1 Service Negotiation for V2G

During the service negotiation phase, the EVSE will offer the V2G service to the EV. The EV will then select this service, to confirm that it fulfills this specification and is aware of the deviations from ISO 15118-2.

To achieve the aforementioned, the EVSE includes an additional service in the ServiceDiscoveryRes. This service will have a ServiceID equal to *28473*, ServiceName equal to "*SAE J2847/2 V2G*," ServiceCategory set to *OtherCustom* and FreeService set to *true*. An example of such a message is shown below:

```
<?xml version="1.0" encoding="UTF-8"?>
<V2G_Message xmlns="urn:iso:15118:2:2013:MsgDef" xmlns:v2gci_h="urn:iso:15118:2:2013:MsgHeader"
xmlns:v2gci_b="urn:iso:15118:2:2013:MsgBody" xmlns:v2gci_dt="urn:iso:15118:2:2013:MsgDataTypes"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:iso:15118:2:2013:MsgDef">
  <Header>
    <v2gci_h:SessionID>AABBCCDDEEFF7788</v2gci_h:SessionID>
  </Header>
  <Body>
    <v2gci_b:ServiceDiscoveryRes>
      <v2gci_b:ResponseCode>OK</v2gci_b:ResponseCode>
      <v2gci_b:PaymentOptionList>
        <v2gci_dt:PaymentOption>ExternalPayment</v2gci_dt:PaymentOption>
      </v2gci_b:PaymentOptionList>
      <v2gci_b:ChargeService>
        <v2gci_dt:ServiceID>1</v2gci_dt:ServiceID>
        <v2gci_dt:ServiceCategory>EVCharging</v2gci_dt:ServiceCategory>
        <v2gci_dt:FreeService>false</v2gci_dt:FreeService>
        <v2gci_dt:SupportedEnergyTransferMode>
          <v2gci_dt:EnergyTransferMode>DC_extended</v2gci_dt:EnergyTransferMode>
        </v2gci_dt:SupportedEnergyTransferMode>
      </v2gci_b:ChargeService>
      <v2gci_b:ServiceList>
        <v2gci_dt:Service>
          <v2gci_dt:ServiceID>28473</v2gci_dt:ServiceID>
          <v2gci_dt:ServiceName>SAE J2847/2 V2G</v2gci_dt:ServiceName>
          <v2gci_dt:ServiceCategory>OtherCustom</v2gci_dt:ServiceCategory>
          <v2gci_dt:FreeService>true</v2gci_dt:FreeService>
        </v2gci_dt:Service>
      </v2gci_b:ServiceList>
    </v2gci_b:ServiceDiscoveryRes>
  </Body>
</V2G_Message>
```

When receiving such a ServiceDiscoveryRes, the EV will select this service by including it in its PaymentServiceSelectionReq. An example of such a message is shown below:


```xml
<?xml version="1.0" encoding="UTF-8"?>
<V2G_Message xmlns="urn:iso:15118:2:2013:MsgDef" xmlns:v2gci_h="urn:iso:15118:2:2013:MsgHeader"
xmlns:v2gci_b="urn:iso:15118:2:2013:MsgBody" xmlns:v2gci_dt="urn:iso:15118:2:2013:MsgDataTypes"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:iso:15118:2:2013:MsgDef">
  <Header>
    <v2gci_h:SessionID>AABBCCDDEEFF7788</v2gci_h:SessionID>
  </Header>
  <Body>
    <v2gci_b:PaymentServiceSelectionReq>
      <v2gci_b:SelectedPaymentOption>ExternalPayment</v2gci_b:SelectedPaymentOption>
      <v2gci_b:SelectedServiceList>
        <v2gci_dt:SelectedService>
          <v2gci_dt:ServiceID>1</v2gci_dt:ServiceID>
        </v2gci_dt:SelectedService>
        <v2gci_dt:SelectedService>
          <v2gci_dt:ServiceID>28472</v2gci_dt:ServiceID>
        </v2gci_dt:SelectedService>
      </v2gci_b:SelectedServiceList>
    </v2gci_b:PaymentServiceSelectionReq>
  </Body>
</V2G_Message>
```


6.10.2 V2G Signals

Unlike V2H where it is only initiated from the home thru the EVSE, the V2G mode of operation can be be inititated either from the home through the EVSE or from the customer through the EV. These are further described in SAE J2836/1 in the direct communication section in Figure 40. Additional HAN protocols can also be used as desired such as Zigbee, Matter, etc.

- If home initiated the signal can be sent using any means identified in Figure 40 going to the EVSE, path #3.
- If customer initiated, the signal can be sent using path 1 or 2.

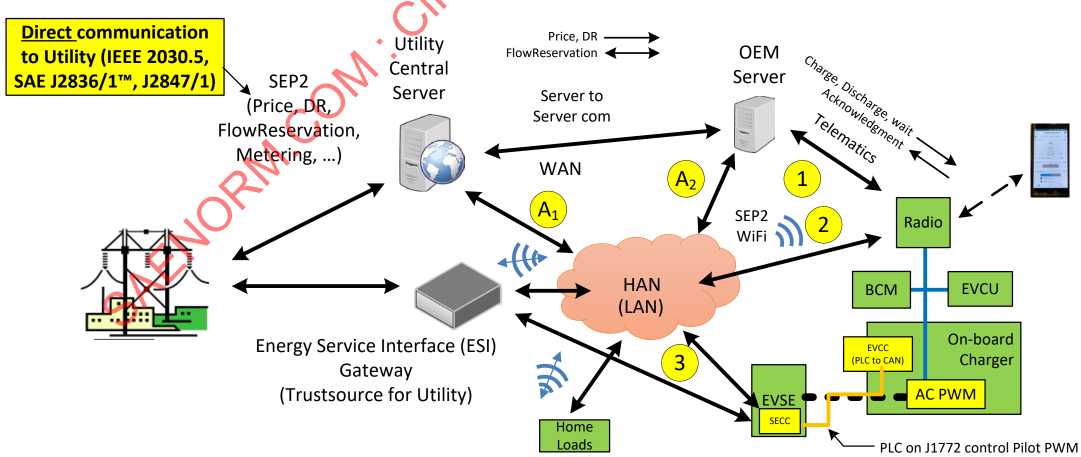


Figure 40 - Direct communication primary actors and optional paths

Since the vehicle can switch from charging and V2G and the V2G commands can be either initiated from the home or EVSE, or the customer or vehicle, the signals need to be clear on how to initiate the process and how to switch.

The V2G negative signals need to start in the energy transfer stage. This is unlike V2H where they start in the Initialization stage. The same signals are used but in different messages. The signals also need to change from charging to V2G (grid following) modes of operation for the inverter with adequate ramp down of the current, switching, then ramp back up to the desired level.

Figure 41 shows the EVSE initiating V2G where the vehicle sends the initial CurrentDemandReq with positive values and the EVSE responds with negative values to trigger V2G. The vehicle then acknowledges the negative signals in the next Reg signal and the handshake is complete with the EVSE Res message.

The method for negative values is the same as used for DC V2H and in the same signals.

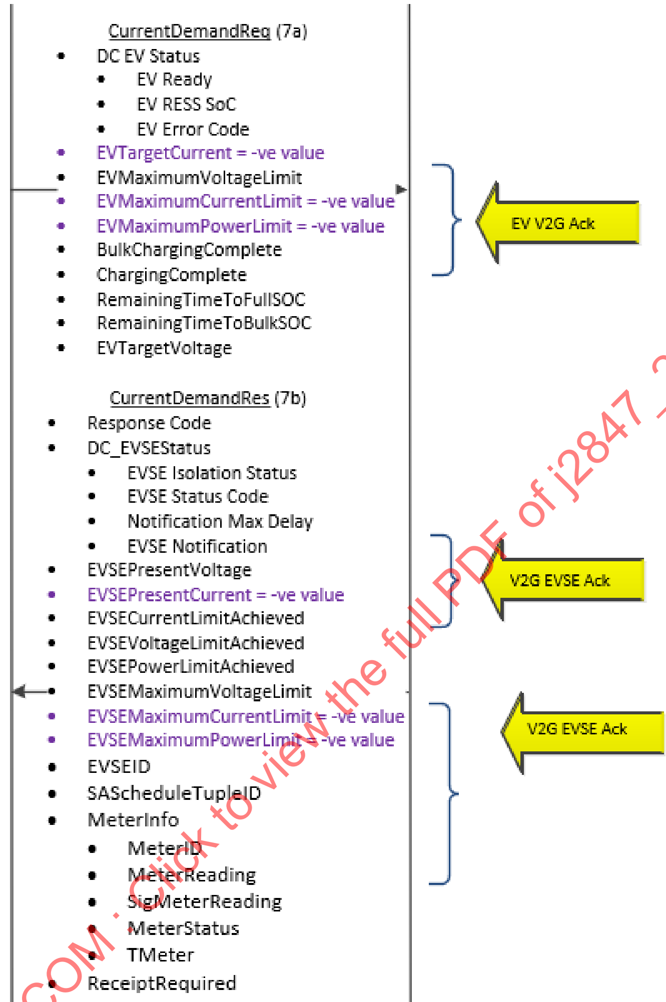


Figure 41 - EVSE initiated V2G

The vehicle initiated V2G starts with negative signals from the initial CurrentDemandReq and the EVSE responds in the first CurrentDemandRes as shown in Figure 42.

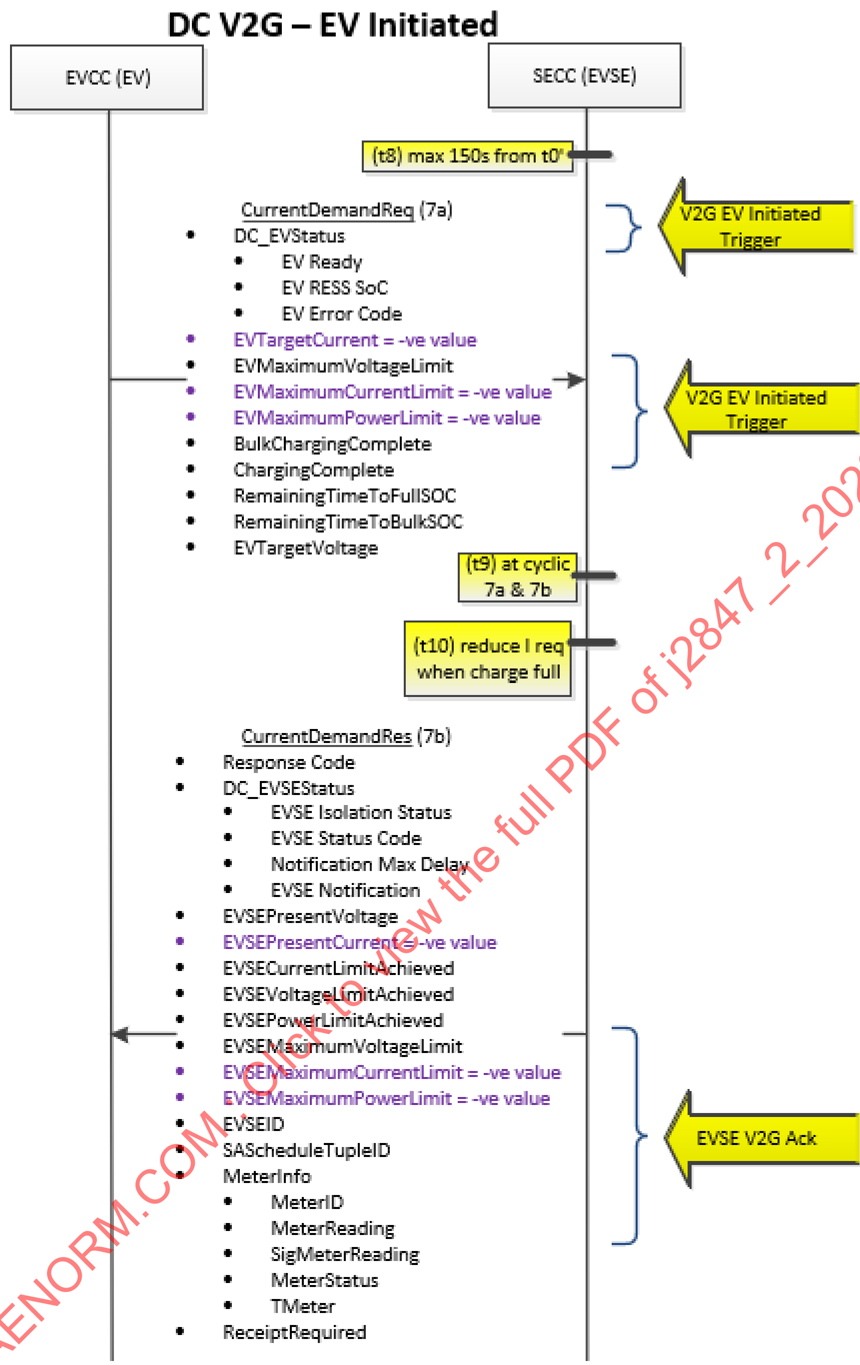


Figure 42 - EV initiated V2G

6.10.2.1 DC V2G Success and Failure Conditions:

- Success is achieved when the handshake is met and both the EVSE and EV exchange negative signals and continue the CurrentDemand message.

- Failure is if the EV may have a fault causing this to not start.

    - The EVSE will terminate the communication and set the pilot PWM to State B1 (no PWM) within 5 seconds.

    - The EVSE also sets Response Code FAILED_SequenceError and the vehicle may then set a fault code corresponding, so the customer or service is informed on the resulting action or an alert is sent to the Home or EV so the charging can start.

6.10.3 Switching Between Charging (Positive) and V2G (Negative) Signals and Vice Versa

In case of bidirectional power transfer where EVTargetCurrent and EVSEPresentCurrent need to switch from negative to positive current or vice versa, these shall include DC 0 kW steps or pause, when switching if required. This pause may not be required depending of the EVSEMinimumCurrentLimit value, if this value is not set to 0 then it means that the EVSE converter is not able to switch from negative to positive without a step at 0 kW and a pause.

6.10.4 Items Not Required for V2G

V2H requires additional items such as the ATS, home balancing transformer, pre-charging the DC EVSE from the home or vehicle, etc. These are not required for V2G.

- The grid transformer will provide the home 120 V phase balancing the same as is done for normal grid power to the home. If the home is isolated from the grid, then the system that is providing the grid forming function is required to include this balancing transformer.

- Precharge of the DC EVSE for V2G is also accomplished from the grid or from the system providing the Grid forming function in the case the home is isolated from the grid.

6.10.5 Applications for V2G

The EV can provide V2G for these use cases:

- The ESS is performing the grid forming function, the EV is grid following.

- The customer desires to reduce peak loads to eliminate demand charges from peak values in Figure 43.

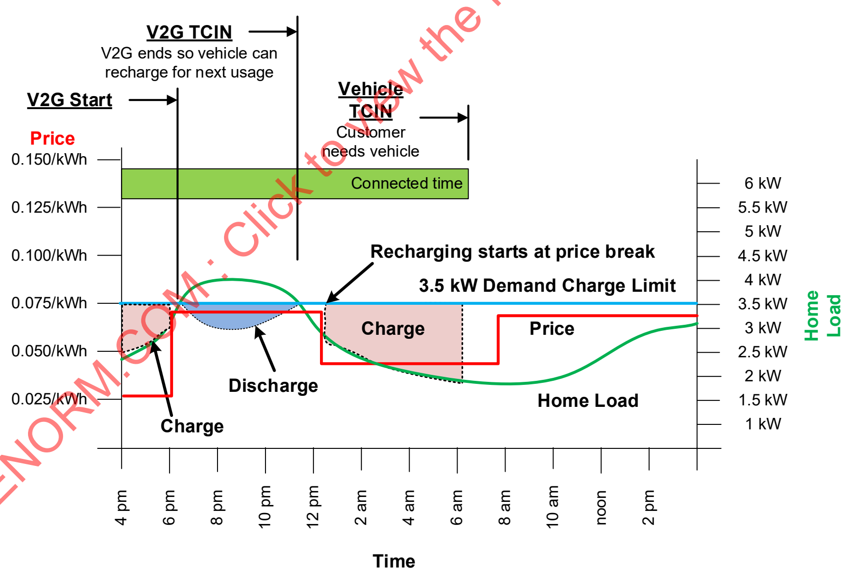


Figure 43 - V2G to eliminate demand charges

- The customer desires the EV to provide all the energy to the home during high cost periods in Figure 44.

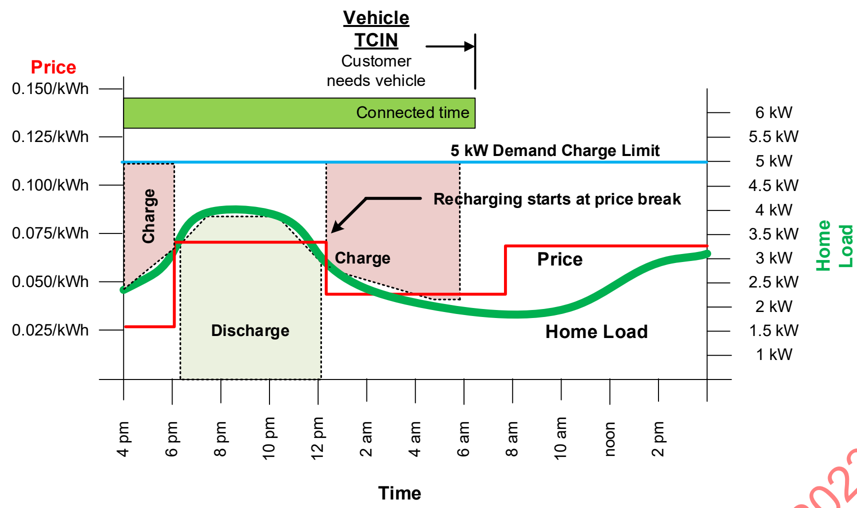


Figure 44 - V2G to eliminate high cost during peak load periods

6.11 ISO 15118-20 Light Design

ISO 15118-20 specifies the communication between electric vehicles and electric vehicle supply equipment. ISO 15118-20's security architecture requires TLS 1.3, strong cryptographic algorithms and tailored certificate profiles. For private environment use cases, a lower security level is acceptable. This section provides a solution that allows using ISO 15118-20's application protocol with ISO 15118-2's security architecture in private environments. This enables implementers to leverage ISO's latest protocol supporting V2H and V2G use cases while reusing significant portions of their security implementation for ISO 15118-2.

6.11.1 Private Environment

In contrast to public infrastructure, it is assumed that the charging infrastructure is operated in a location that is not freely accessible and is therefore private. A PE could include a private plot of land, a private garage, a private parking space or a privately operated multi-story car park. A PE EVSE owner can be a natural person or a smaller company that does not act publicly. As a rule, the PE EVSE is not freely accessible in a PE, so that access to the private infrastructure is only granted to a restricted group of users who have been authorized by the PE EVSE owner. Authorized in this context means that the PE EVSE owner grants the EVs the right to charge by giving access to the PE EVSE and, if necessary, giving the user the option of preparing their EV for charging at this PE EVSE.

6.11.2 CPM4PE

ISO 15118-20 defines CPM4PE (certificate provisioning mode for private environment) as a means to exchange trust anchors for secure communication in a private environment. CPM4PE requires user interaction on both the EVSE and the EV to initiate a pairing process. During the pairing process the SECC transmits its root certificate as part of the TLS handshake's Certificate message and the EVCC learns it as a trust anchor for private environments. Subsequently, the EVCC will be able to properly authenticate the SECC during a future TLS handshake. Further details on CPM4PE can be found is ISO 15118-20.

Figure 45 show the optional path for negotiation.

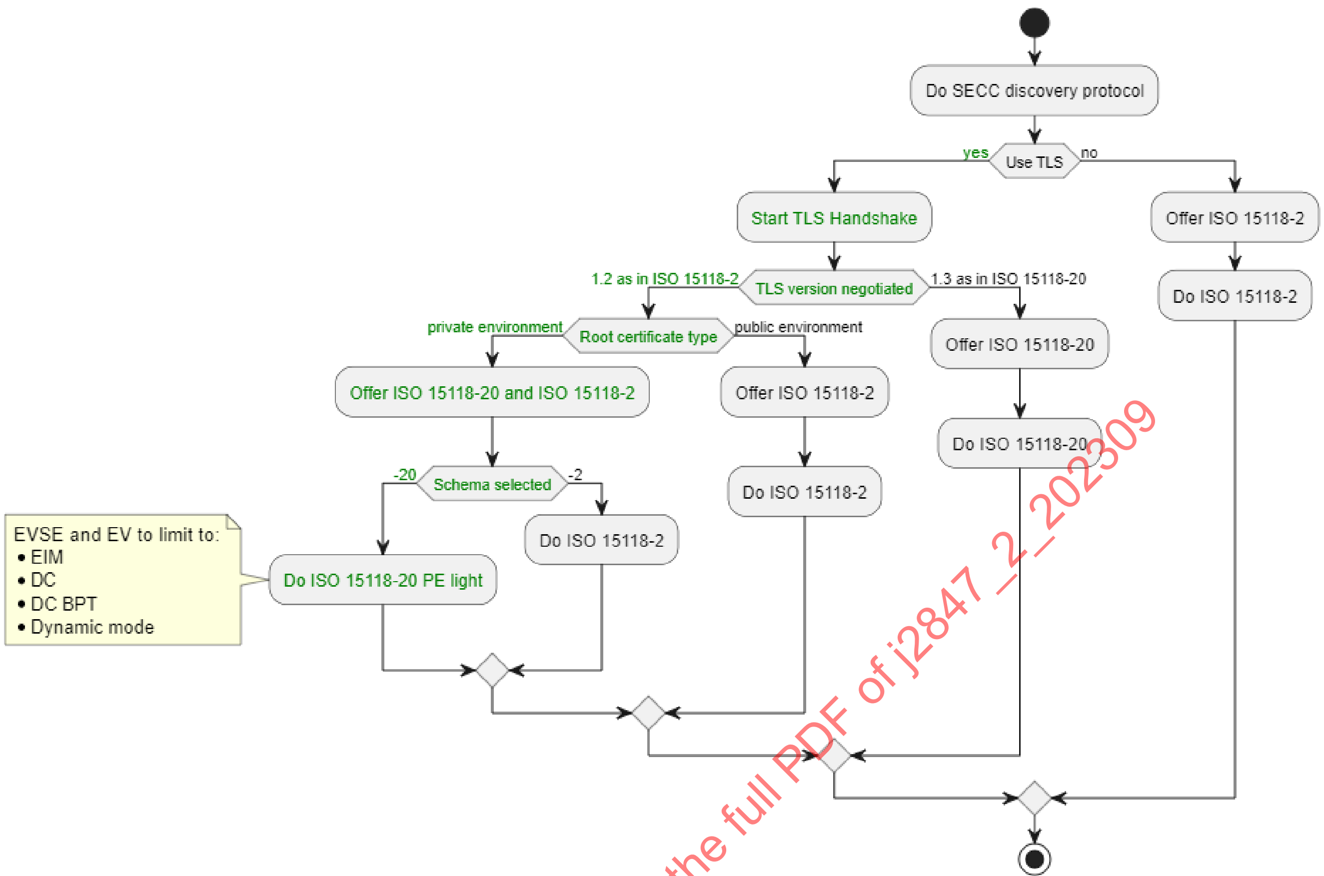


Figure 45 - ISO 15118-20 light handshake diagram

6.11.3 Protocol

6.11.3.1 TLS Handshake

[V2G20-SAE1] An EVCC should be able to perform a TLS handshake using version 1.2 as specified in ISO 15118-2.

[V2G20-SAE2] A SECC shall be able to perform a TLS handshake using version 1.2 as specified in ISO 15118-2.

[V2G20-SAE3] An EVCC should support cryptographic algorithms specified in ISO 15118-2.

[V2G20-SAE4] An SECC shall support cryptographic algorithms specified in ISO 15118-2.

[V2G20-SAE5] An EVCC should support certificate profiles specified in ISO 15118-2.

[V2G20-SAE6] An SECC shall support certificate profiles specified in ISO 15118-2.

NOTE: EVCC is not required to accept a TLSv1.2 handshake (“should”). However, it is recommended to further interoperability in private environments (PE) that the EVSE accepts a TLS 1.2 handshake.

[V2G20-SAE7] If an EVCC performs a TLS handshake according to ISO 15118-2 and if it is in CPM4PE-mode, the EVCC shall accept and learn certificates specified in ISO 15118-2 for PE.

[V2G20-SAE8] If an EVSE manufacturer installs its EVSEs in private and public environment then, the SECC in a public environment shall only provide certificates up to Sub CA1 level during a TLS handshake

NOTE: A root certificate must never be transmitted in a public environment. Thus CPM4PE is effectively not allowed in public chargers.

6.11.3.2 Application Protocol

[V2G20-SAE9] If an EVCC successfully performed a TLS handshake according to ISO 15118-2 using a PE root certificate, the EVCC should offer ISO 15118-20 schema as part of the supportedAppProtocolReq.

[V2G20-SAE10] If a SECC successfully performed a TLS handshake according to ISO 15118-2 using a PE root certificate, the SECC should select ISO 15118-20 schema in the supportedAppProtocolRes.

[V2G20-SAE11] An EVCC should support the ISO 15118-20 application layer messages.

[V2G20-SAE12] An SECC shall support the ISO 15118-20 application layer messages.

[V2G20-SAE13] If an EVCC successfully performed a TLS handshake according to ISO 15118-2 using a PE root certificate and if ISO 15118-20 schema was selected, the EVCC shall use only the services with the ServiceName as specified in ISO 15118-20, Table 204.

- DC
- DC_BPT

[V2G20-SAE14] If an SECC successfully performed a TLS handshake according to ISO 15118-2 using a PE root certificate and if ISO 15118-20 schema was selected, the SECC shall offer only the following services with the ServiceName as specified in ISO 15118-20 Table 204.

- DC
- DC_BPT

[V2G20-SAE15] If an EVCC successfully performed a TLS handshake according to ISO 15118-2 using a PE root certificate and if ISO 15118-20 schema was selected, the EVCC shall use only the following ControlMode as specified in ISO 15118-20 Table 207/208.

- Dynamic

[V2G20-SAE16] If an SECC successfully performed a TLS handshake according to ISO 15118-2 using a PE root certificate and if ISO 15118-20 schema was selected, the SECC shall offer only the following ControlMode as specified in ISO 15118-20 Table 207/208.

- Dynamic

[V2G20-SAE17] If an SECC successfully performed a TLS handshake according to ISO 15118-2 using a PE root certificate and if ISO 15118-20 schema was selected, the SECC shall offer only EIM in the AuthorizationSetupRes message.

6.11.4 Message Sequence Description

This section lists all the V2G messages needed for DC bi-directional charging in dynamic control mode. Under each message pair section there are three parts:

- General, which describes values for some key parameters in the message pair;
- Error handling, which describes how the system shall react when certain error occurs; and
- Message example, which provides the implementation of the message pair with all mandatory fields and valid parameter values.

6.11.4.1 SupportedAppProtocolReq/Res

- General

ProtocolNamespace= urn:iso:std:iso:15118:-20:DC

VersionNumberMajor =1,

VersionNumberMinor =0,

SchemaID= 0

NOTE: It is assumed that only one schema with -20:DC namespace will be used for this guide. If more than one schema is offered, the -20:DC namespace shall have the highest priority for the DC BPT testing to continue.

Related requirements from ISO 15118-20: **[V2G20-2132]**.

- Error Handling

[ChIN-BPT-001] If TLS 1.3 is established, the SECC shall send back the schemaID which corresponds to -20:DC namespace. If the EVCC does not offer -20:DC namespace, the SECC shall respond with response code Failed_NoNegotiation. If negotiation is not successful, the EVCC shall proceed to terminate the communication.

NOTE: This requirement is specific for DC BPT testing as this is a functionality supported only by ISO 15118-20.

Related requirements from ISO 15118-20: **[V2G20-172].**

- Message example

SupportedAppProtocolReq

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ns0:supportedAppProtocolReq xmlns:ns0="urn:iso:15118:2:2010:AppProtocol">
  <AppProtocol>
    <ProtocolNamespace>urn:iso:std:iso:15118:-20:DC</ProtocolNamespace>
    <VersionNumberMajor>1</VersionNumberMajor>
    <VersionNumberMinor>0</VersionNumberMinor>
    <SchemaID>2</SchemaID>
    <Priority>1</Priority>
  </AppProtocol>
</ns0:supportedAppProtocolReq>
```

SupportedAppProtocolRes

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ns0:supportedAppProtocolRes xmlns:ns0="urn:iso:15118:2:2010:AppProtocol">
  <ResponseCode>OK_SuccessfulNegotiation</ResponseCode>
  <SchemaID>2</SchemaID>
</ns0:supportedAppProtocolRes>
```

6.11.4.2 SessionSetupReq

- General

SessionSetupReq:

SessionID = 0 (0x00000000) (see message example)

EVCCID = CHAV0123456789ABCDE3

SessionSetupRes:

SessionID != 0

ResponseCode = OK_NewSessionEstablished

EVSEID = ZZ000000

NOTE: The sessionID is an element of fixed size 8 hexBinary and it shall be zero if a new session is intended to be established (always in the context of this CharIN guide, since pause/standby is not supported).

[ChIN-BPT-002] EVSEID in SessionSetupRes shall be ZZ000000 for this guide. The EV shall accept this EVSEID.

[ChIN-BPT-003] EVCCID communicated over V2G message shall be identical to the vehicle certificate leaf (see Table B.6a in ISO 15118-20).

SECCID is only used in the SECC cert leaf (see Section B.4.1 Table B.5 in ISO 15118-20).

[ChIN-BPT-004] The following EVCCID and SECCID shall be used for this guide: EVCCID: cha-V-0123456789abcde-3 SECCID: AA-CHA-S-01234567890123456789012345678901-6

- Error handling

[ChIN-BPT-005] If the SECC receives a SessionSetupReq including a SessionID value which is not equal to zero (0x00), it shall send a SessionID value in the SessionSetupRes message that is unequal to "0x00" and indicate the new V2G communication session with the ResponseCode set to "OK_NewSessionEstablished."

NOTE: As Session Pause and Resume is not considered in this guide, the SECC is not expected to store any previous sessionID, and therefore will always start a new session.

Related requirements from ISO 15118-20: **[V2G20-2547].**

- Message example

SessionSetupReq


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:SessionSetupReq xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>0000000000000000</p1:SessionID>
        <p1:TimeStamp>1624366042</p1:TimeStamp>
    </p1:Header>
    <p0:EVCCID>CHAV0123456789ABCDE3</p0:EVCCID>
</p0:SessionSetupReq>
```


SessionSetupRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:SessionSetupRes xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366043</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-
20:CommonTypes">OK_NewSessionEstablished</p1:ResponseCode>
    <p0:EVSEID>ZZ000000</p0:EVSEID>
</p0:SessionSetupRes>
```


6.11.4.3 AuthorizationSetupReq/Res

- General

AuthorizationSetupReq: empty

AuthorizationSetupRes:

AuthorizationServices: EIM

CertificationInstallationSevice: False

EIM_ASResAuthorizationMode: empty

NOTE: As only EIM is considered in this guide, PnC service is not offered.

- Error handling

None.

- Message example

AuthorizationSetupReq

```
<?xml version="1.0" encoding="UTF-8"?>
<ns0:AuthorizationSetupReq xmlns:ns0="urn:iso:std:iso:15118:-20:CommonMessages">
  <ns1:Header xmlns:ns1="urn:iso:std:iso:15118:-20:CommonTypes">
    <ns1:SessionID>3933323835363733</ns1:SessionID>
    <ns1:TimeStamp>1620044866</ns1:TimeStamp>
  </ns1:Header>
</ns0:AuthorizationSetupReq>
```

AuthorizationSetupRes

```
<?xml version="1.0" encoding="UTF-8"?>
<p0:AuthorizationSetupRes xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366043</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
    <p0:AuthorizationServices>EIM</p0:AuthorizationServices>
    <p0:CertificateInstallationService>false</p0:CertificateInstallationService>
    <p0:EIM_ASResAuthorizationMode/>
</p0:AuthorizationSetupRes>
```

6.11.4.4 AuthorizationReq/Res

- General

AuthorizationReq:

SelectedAuthorizationService: EIM

EIM_AReqAuthorizationMode: empty

AuthorizationRes:

ResponseCode = OK

EVSEProcessing = Ongoing/Finished when authorization is done

- Error handling

[ChIN-BPT-006] If the SelectedAuthorizationService in AuthorizationReq is not EIM, the SECC shall send AuthorizationRes with ResponseCode = WARNING_AuthorizationSelectionInvalid.

[ChIN-BPT-007] The EVCC shall send an AuthorizationReq message with SelectedAuthorizationService = EIM after receiving an AuthorizationRes with ResponseCode = WARNING_AuthorizationSelectionInvalid.

[ChIN-BPT-008] The SECC shall wait for maximum three AuthorizationReq messages if the previous AuthorizationRes is with ResponseCode = WARNING_AuthorizationSelectionInvalid. After that the SECC shall respond with FAILED if the SelectedAuthorizationService in AuthorizationReq is still not EIM.

Related requirements in ISO 15118-20: **[V2G20-1583]**, **[V2G20-2209]**, **[V2G20-2219]**.

- Message example

AuthorizationReq

```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:AuthorizationReq xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366043</p1:TimeStamp>
    </p1:Header>
    <p0:SelectedAuthorizationService>EIM</p0:SelectedAuthorizationService>
    <p0:EIM_AReqAuthorizationMode/>
</p0:AuthorizationReq>
```

AuthorizationRes

```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:AuthorizationRes xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366043</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
    <p0:EVSEProcessing>Finished</p0:EVSEProcessing>
</p0:AuthorizationRes>
```

6.11.4.5 ServiceDiscoveryReq/Res

- General

ServiceDiscoveryRes:

ServiceRenegotiationSupported = false

ServiceID = 6

FreeService = true/false

The serviceID in ServiceDiscoveryReq is optional.

[ChIN-BPT-009] Independent from the ServiceID in the ServiceDiscoveryReq, the SECC shall send ServiceID= 6 (DC_BPT) in ServiceDiscoveryRes.

The FreeService may be set to true or false.

[ChIN-BPT-010] The EVCC shall accept both true and false for FreeService.

- Error handling

[ChIN-BPT-011] If the SECC does not send ServiceID = 6 in ServiceDiscoveryRes, the EVCC shall send SessionStopReq to stop the session with EVTerminationCode = 1 and EVTerminationExplanation = WrongServiceID.

- Message example

ServiceDiscoveryReq

```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:ServiceDiscoveryReq xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366043</p1:TimeStamp>
    </p1:Header>
</p0:ServiceDiscoveryReq>
```

ServiceDiscoveryRes

```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:ServiceDiscoveryRes xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
<p1:SessionID>3933323835363733</p1:SessionID>
<p1:TimeStamp>1624366043</p1:TimeStamp>
</p1:Header>
<p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
<p0:ServiceRenegotiationSupported>false</p0:ServiceRenegotiationSupported>
<p0:EnergyTransferServiceList>
<p0:Service>
<p0:ServiceID>6</p0:ServiceID>
<p0:FreeService>false</p0:FreeService>
</p0:Service>
</p0:EnergyTransferServiceList>
</p0:ServiceDiscoveryRes>
```


6.11.4.6 ServiceDetailsReq/Res

- General

ServiceDetailsReq:

ServiceID = 6

ServiceDetailsRes:

ServiceID = 6

ParameterSetID = 1:

Table 112 - ServiceDetailsReq/Res values

Connector = 2	Extended
ControlMode=2	Dynamic
MobilityNeedsMode=1	Mobility needs provided by SECC not allowed
Pricing=0	No pricing
BPTChannel=1	Unified
GeneratorMode	Grid following or grid forming

NOTE 1: MobilityNeedsMode=2 leads to complexity in ScheduleExchange parameters; see requirement **[V2G20-1648]/[V2G20-1649]**. For this first version of the guide the MobilityNeedsMode is limited to 1.

NOTE 2: By offering grid following or grid forming the EVSE will let the EV know in which mode it is. Grid following is signaling the EV that a grid is present. This mode is also referred to V2G. Grid forming means that there is no grid present. This is the case in V2H/emergency scenarios.

- Error handling

ServiceDetailReq

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ns0:ServiceDetailReq xmlns:ns0="urn:iso:std:iso:15118:-20:CommonMessages">
  <ns1:Header xmlns:ns1="urn:iso:std:iso:15118:-20:CommonTypes">
    <ns1:SessionID>3933323835363733</ns1:SessionID>
    <ns1:TimeStamp>1624366043</ns1:TimeStamp>
  </ns1:Header>
  <ns0:ServiceID>6</ns0:ServiceID>
</ns0:ServiceDetailReq>
```

ServiceDetailRes

```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:ServiceDetailRes xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366043</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
    <p0:ServiceID>6</p0:ServiceID>
    <p0:ServiceParameterList>
        <p0:ParameterSet>
            <p0:ParameterSetID>1</p0:ParameterSetID>
            <p0:Parameter p0:Name="Connector">
                <p0:intValue>2</p0:intValue>
            </p0:Parameter>
            <p0:Parameter p0:Name="ControlMode">
                <p0:intValue>2</p0:intValue>
            </p0:Parameter>
            <p0:Parameter p0:Name="MobilityNeedsMode">
                <p0:intValue>1</p0:intValue>
            </p0:Parameter>
            <p0:Parameter p0:Name="Pricing">
                <p0:intValue>0</p0:intValue>
            </p0:Parameter>
            <p0:Parameter p0:Name="BPTChannel">
                <p0:intValue>1</p0:intValue>
            </p0:Parameter>
            <p0:Parameter p0:Name="GeneratorMode">
                <p0:intValue>1</p0:intValue>
            </p0:Parameter>
        </p0:ParameterSet>
    </p0:ServiceParameterList>
</p0:ServiceDetailRes>
```


6.11.4.7 ServiceSelectionReq/Res

- General

ServiceSelectionReq: ServiceID = 6 ParameterSetID = 1

ServiceSelectionRes: ResponseCode = OK

- Error handling

[ChIN-BPT-013] If in ServiceSelectionReq the ServiceID !=6 or ParameterSetID !=1, ServiceSelectionRes shall contain FAILED_ServiceSelectionInvalid in the ResponseCode.

Requirement from ISO 15118-20: **[V2G20-433]**.

- Message example

ServiceSelectionReq


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:ServiceSelectionReq xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366043</p1:TimeStamp>
    </p1:Header>
    <p0:SelectedEnergyTransferService>
        <p0:ServiceID>6</p0:ServiceID>
        <p0:ParameterSetID>1</p0:ParameterSetID>
    </p0:SelectedEnergyTransferService>
</p0:ServiceSelectionReq>
```


ServiceSelectionRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:ServiceSelectionRes xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366043</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
</p0:ServiceSelectionRes>
```


6.11.4.8 DC_ChargeParameterDiscoveryReq/Res

- General

There is no preset parameter in this message pair for this guide as all parameters shall be dependent on the electrical aspects of the EV and EVSE.

NOTE: In this guide, all optional parameters are not used, such as TargetSoC in DC_ChargeParameterDiscoveryReq.

[ChIN-BPT-014] Any optional parameters in DC_ChargeParameterDiscoveryReq/Res may not be considered in the charging session.

- Error handling

[ChIN-BPT-015] The SECC shall validate the validity of the parameters exchanged in the DC_ChargeParameterDiscoveryReq message. If invalid parameters are exchanged or if BPT_DC_CPDReqEnergyTransferMode is not used, the DC_ChargeParameterDiscoveryRes shall contain ResponseCode = FAILED_WrongChargeParameter.

Related requirement in ISO 15118-20: **[V2G20-2272]**.

- Message Example

DC_ChargeParameterDiscoveryReq


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_ChargeParameterDiscoveryReq xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366044</p1:TimeStamp>
    </p1:Header>
    <p0:BPT_DC_CPDReqEnergyTransferMode>
        <p0:EVMaximumChargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">7</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Value>
        </p0:EVMaximumChargePower>
        <p0:EVMinimumChargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">5</p1:Value>
        </p0:EVMinimumChargePower>
        <p0:EVMaximumChargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Value>
        </p0:EVMaximumChargeCurrent>
        <p0:EVMinimumChargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">2</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Value>
        </p0:EVMinimumChargeCurrent>
        <p0:EVMaximumVoltage>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">360</p1:Value>
        </p0:EVMaximumVoltage>
        <p0:EVMinimumVoltage>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">310</p1:Value>
        </p0:EVMinimumVoltage>
        <p0:TargetSOC>85</p0:TargetSOC>
        <p0:EVMaximumDischargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">5</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Value>
        </p0:EVMaximumDischargePower>
        <p0:EVMinimumDischargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">5</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Value>
        </p0:EVMinimumDischargePower>
        <p0:EVMaximumDischargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">2</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Value>
        </p0:EVMaximumDischargeCurrent>
        <p0:EVMinimumDischargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">2</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Value>
        </p0:EVMinimumDischargeCurrent>
    </p0:BPT_DC_CPDReqEnergyTransferMode>
</p0:DC_ChargeParameterDiscoveryReq>
```

DC_ChargeParameterDiscoveryRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_ChargeParameterDiscoveryRes xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366044</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
    <p0:BPT_DC_CPDResEnergyTransferMode>
        <p0:EVSEMaximumChargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">11</p1:Value>
        </p0:EVSEMaximumChargePower>
        <p0:EVSEMinimumChargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">500</p1:Value>
        </p0:EVSEMinimumChargePower>
        <p0:EVSEMaximumChargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Value>
        </p0:EVSEMaximumChargeCurrent>
        <p0:EVSEMinimumChargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Value>
        </p0:EVSEMinimumChargeCurrent>
        <p0:EVSEMaximumVoltage>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">2</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Value>
        </p0:EVSEMaximumVoltage>
        <p0:EVSEMinimumVoltage>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">250</p1:Value>
        </p0:EVSEMinimumVoltage>
        <p0:EVSEMaximumDischargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">11</p1:Value>
        </p0:EVSEMaximumDischargePower>
        <p0:EVSEMinimumDischargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">500</p1:Value>
        </p0:EVSEMinimumDischargePower>
        <p0:EVSEMaximumDischargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Value>
        </p0:EVSEMaximumDischargeCurrent>
        <p0:EVSEMinimumDischargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Value>
        </p0:EVSEMinimumDischargeCurrent>
    </p0:BPT_DC_CPDResEnergyTransferMode>
</p0:DC_ChargeParameterDiscoveryRes>
```


6.11.4.9 ScheduleExchangeReq/Res

- General

ScheduleExchangeReq/Res message set is also mandatory even though this guide covers only dynamic control mode.

ScheduleExchangeReq:

MaximumSupportingPoints = 12

Dynamic_SEReqControlMode

Table 113 - ScheduleExchangeReq/Res

DepartureTime (seconds)	>0. The range of the departure time shall be within the range of 15 mins (900) to 12 hours (43200) for this guide. Note: this range limitation is for interoperability testing purposes only. Per ISO 15118-20, the range is limited by type definition of unsignedInt.
EVTargetEnergyRequest	The energy request of the EV it needs to fulfil the target SOC as specified by the owner.
EVMaximumEnergyRequest	Maximum acceptable energy level of the EV
EVMinimumEnergyRequest	The energy request of the EV it needs to fulfil the minimum SOC as specified by the owner. Note: Not a guaranteed minimal amount

ScheduleExchangeRes:

ResponseCode = OK

EVSEProcessing = Ongoing/Finished if Req is processed successfully

NOTE 1: The parameters related to current, power and voltage provided in ScheduleExchange message pair should be considered as physical limitations, meaning that they are related to the physical abilities of the system under rated operating conditions. The values can be changed later in the energy transfer process.

NOTE 2: Optional parameters are not considered in this guide.

- Error handling

[ChIN-BPT-016] If the EVMinimumEnergyRequest is greater than EVMaximumEnergyRequest or EVTargetEnergyRequest, the SECC shall respond with ResponseCode = FAILED. The charging session will be terminated.

[ChIN-BPT-017] If multiple ScheduleExchangeReq messages with different parameter values are received, the value in the lastest ScheduleExchangeReq shall be used.

- Message Example

ScheduleExchangeReq


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:ScheduleExchangeReq xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366044</p1:TimeStamp>
    </p1:Header>
    <p0:MaximumSupportingPoints>12</p0:MaximumSupportingPoints>
    <p0:Dynamic_SEReqControlMode>
        <p0:DepartureTime>3600</p0:DepartureTime>
        <p0:EVTargetEnergyRequest>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">60</p1:Value>
        </p0:EVTargetEnergyRequest>
        <p0:EVMaximumEnergyRequest>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">67</p1:Value>
        </p0:EVMaximumEnergyRequest>
        <p0:EVMinimumEnergyRequest>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">10</p1:Value>
        </p0:EVMinimumEnergyRequest>
    </p0:Dynamic_SEReqControlMode>
</p0:ScheduleExchangeReq>
```

ScheduleExchangeRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:ScheduleExchangeRes xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366044</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
    <p0:EVSEProcessing>Finished</p0:EVSEProcessing>
    <p0:Dynamic_SEResControlMode></p0:Dynamic_SEResControlMode>
</p0:ScheduleExchangeRes>
```


6.11.4.10 DC_CableCheckReq/Res

- General

DC_CableCheckReq : empty

DC_CableCheckRes:

ResponseCode = OK

EVSEProcessing = Ongoing. Setting to Finished when cable check is done.

- Error handling

None.

- Message example

DC_CableCheckReq


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_CableCheckReq xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366044</p1:TimeStamp>
    </p1:Header>
</p0:DC_CableCheckReq>
```


DC_CableCheckRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_CableCheckRes xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366044</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
    <p0:EVSEProcessing>Finished</p0:EVSEProcessing>
</p0:DC_CableCheckRes>
```

6.11.4.11 DC_PreChargeReq/Res

- General

DC_PreChargeReq:

EVProcessing = Ongoing. Setting to Finished when the EV wants to move onto the next sequence

EVPresentVoltage = Voltage of the EV at inlet

EVTargetVoltage = Voltage the EVSE shall reach for the EV to end the pre-charge phase

DC_PreChargeRes:

ResponseCode = OK

EVSEPresentVoltage = EVSE output voltage

NOTE 1: EVPresentVoltage is the voltage that the EV measures at the inlet. The target is reached if EVPresentVoltage is equal to EVTargetVoltage. The usage of the EVPresentVoltage and EVTargetVoltage shall be referred to the Electrical System Implementation Guide.

NOTE 2: The precision of the measurement in the EV will be defined in ISO 5474 series which is not yet published. The EVSE shall take this lack of standardized measurement precision into account if it is taking this measurement value as base for certain decisions.

- Error Handling

None.

- Message Example

DC_PreChargeReq


```
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_PreChargeReq xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366044</p1:TimeStamp>
    </p1:Header>
    <p0:EVProcessing>Ongoing</p0:EVProcessing>
    <p0:EVPresentVoltage>
        <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
        <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Value>
    </p0:EVPresentVoltage>
    <p0:EVTargetVoltage>
        <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
        <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">330</p1:Value>
    </p0:EVTargetVoltage>
</p0:DC_PreChargeReq>
```

DC_PreChargeRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_PreChargeRes xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366044</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
    <p0:EVSEPresentVoltage>
        <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
        <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">330</p1:Value>
    </p0:EVSEPresentVoltage>
</p0:DC_PreChargeRes>
```


6.11.4.12 PowerDeliveryReq/Res

- General

PowerDeliveryReq:

EVProcessing = Ongoing/Finished

ChargeProgress = Start to start charging/Stop to stop charging

NOTE 1: Pause and Standby are not supported in this guide. EVPowerProfile is optional and will not be used in this guide

NOTE 2: BPT_ChannelSelection is only used if power channel switching is required between Charging and Discharging. Therefore not used in this guide.

PowerDeliveryRes:

ResponseCode = OK

- Error handling

[ChIN-BPT-018] If ChargeProgress = Standby is used in PowerDeliveryReq, the SECC may terminate the charging process as if ChargeProgess = Stop is received in this guide.

[ChIN-BPT-019] If the EVSE is not able to perform power transfer in both directions, the message PowerDeliveryRes shall contain ResponseCode = FAILED_PowerDeliveryNotApplied.

Related requirements in ISO 15118-20: **[V2G20-1411]**.

- Message example

PowerDeliveryReq


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:PowerDeliveryReq xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366045</p1:TimeStamp>
    </p1:Header>
    <p0:EVProcessing>Finished</p0:EVProcessing>
    <p0:ChargeProgress>Start</p0:ChargeProgress>
</p0:PowerDeliveryReq>
```

PowerDeliveryRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:PowerDeliveryRes xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366045</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
</p0:PowerDeliveryRes>
```


6.11.4.13 DC_ChargeLoopReq/Res

- General

DC_ChargeLoopReq:

MeterInfoRequested = False

NOTE 1: For simplicity, MeterInfo is not supported in this guide.

EVPresentVoltage = present voltage of the EV measured at the EV inlet

BPT_Dynamic_DC_CLReqControlMode: only mandatory parameters are used.

NOTE 2: EVMaximumV2XEnergyRequest and EVMinimumV2XEnergyRequest are optional parameters and will not be used in the first version of this guide. The EVSE may nt take these values into consideration during chargeLoop.

NOTE 3: The EVMaximumEnergyRequest and EVMinimumEnergyRequest may be used to limit the bi-directional power transfer region.

DC_ChargeLoopRes:

ResponseCode = OK

EVSEPresentCurrent

EVSEPresentVoltage

EVSEPowerLimitAchieved: true when EVSE has reached its power limit

EVSECurrentLimitAchieved: true when EVSE has reached its current limit

EVSEVoltageLimitAchieved: true when EVSE has reached its voltage limit

BPT_Dynamic_DC_CLResControlMode: only mandatory parameters are used

[ChIN-BPT-020] The EVSE shall respect the limits of EVMaximumPower and EVMaximumCurrent, whichever is lower, during the charging

- Error handling

[ChIN-BPT-021] If the EVSE sends MeterInfo in DC_ChargeLoopRes when the MeterInforRequested in DC_ChargeLoopReq = false, the EV shall ignore the MeterInfo received.

[ChIN-BPT-022] If the limits communicated in the DC_chargeLoopReq are exceeded by the EVSE (for example, EVSEPresentCurrent > EVMaximumChargeCurrent), the EVSE may expect that the EV terminates the charging session.

[ChIN-BPT-023] If the EVMaximumEnergyLevel/EVMinimumEnergyLevel are not fulfilled at anytime during the charging session (except when the charging session is started outside of the range of EVMaximumEnergyLevel/EVMinimumEnergyLevel), the EVSE may expect that the EV terminates the charging session.

DC_ChargeLoopReq


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_ChargeLoopReq xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366045</p1:TimeStamp>
    </p1:Header>
    <p1:MeterInfoRequested xmlns:p1="urn:iso:std:iso:15118:-
20:CommonTypes">false</p1:MeterInfoRequested>
    <p0:EVPresentVoltage>
        <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
        <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">330</p1:Value>
    </p0:EVPresentVoltage>
    <p0:BPT_Dynamic_DC_CLReqControlMode>
        <p1:EVTargetEnergyRequest xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
            <p1:Exponent>6</p1:Exponent>
            <p1:Value>6</p1:Value>
        </p1:EVTargetEnergyRequest>
        <p1:EVMaximumEnergyRequest xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
            <p1:Exponent>4</p1:Exponent>
            <p1:Value>7</p1:Value>
        </p1:EVMaximumEnergyRequest>
        <p1:EVMinimumEnergyRequest xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
            <p1:Exponent>0</p1:Exponent>
            <p1:Value>0</p1:Value>
        </p1:EVMinimumEnergyRequest>
        <p0:EVMaximumChargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">7</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Value>
        </p0:EVMaximumChargePower>
        <p0:EVMinimumChargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">5</p1:Value>
        </p0:EVMinimumChargePower>
        <p0:EVMaximumChargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Value>
        </p0:EVMaximumChargeCurrent>
        <p0:EVMaximumVoltage>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">360</p1:Value>
        </p0:EVMaximumVoltage>
        <p0:EVMinimumVoltage>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">310</p1:Value>
        </p0:EVMinimumVoltage>
        <p0:EVMaximumDischargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">5</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Value>
        </p0:EVMaximumDischargePower>
        <p0:EVMinimumDischargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">5</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Value>
        </p0:EVMinimumDischargePower>
        <p0:EVMaximumDischargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">2</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Value>
        </p0:EVMaximumDischargeCurrent>
    </p0:BPT_Dynamic_DC_CLReqControlMode>
</p0:DC_ChargeLoopReq>
```

DC_ChargeLoopRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_ChargeLoopRes xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366045</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
    <p0:EVSEPresentCurrent>
        <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Exponent>
        <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Value>
    </p0:EVSEPresentCurrent>
    <p0:EVSEPresentVoltage>
        <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Exponent>
        <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Value>
    </p0:EVSEPresentVoltage>
    <p0:EVSEPowerLimitAchieved>false</p0:EVSEPowerLimitAchieved>
    <p0:EVSECurrentLimitAchieved>false</p0:EVSECurrentLimitAchieved>
    <p0:EVSEVoltageLimitAchieved>false</p0:EVSEVoltageLimitAchieved>
    <p0:BPT_Dynamic_DC_CLResControlMode>
        <p0:EVSEMaximumChargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">11</p1:Value>
        </p0:EVSEMaximumChargePower>
        <p0:EVSEMinimumChargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">500</p1:Value>
        </p0:EVSEMinimumChargePower>
        <p0:EVSEMaximumChargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">20</p1:Value>
        </p0:EVSEMaximumChargeCurrent>
        <p0:EVSEMaximumVoltage>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">2</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">4</p1:Value>
        </p0:EVSEMaximumVoltage>
        <p0:EVSEMaximumDischargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">3</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">11</p1:Value>
        </p0:EVSEMaximumDischargePower>
        <p0:EVSEMinimumDischargePower>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">500</p1:Value>
        </p0:EVSEMinimumDischargePower>
        <p0:EVSEMaximumDischargeCurrent>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">1</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">20</p1:Value>
        </p0:EVSEMaximumDischargeCurrent>
        <p0:EVSEMinimumVoltage>
            <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
            <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">250</p1:Value>
        </p0:EVSEMinimumVoltage>
    </p0:BPT_Dynamic_DC_CLResControlMode>
</p0:DC_ChargeLoopRes>
```

6.11.4.14 DC_WeldingDetectionReq/Res

- General

DC_WeldingDetectionReq:

EVProcessing = Ongoing/Finished till welding detection is done

DC_WeldingDetectionRes:

ResponseCode = OK

EVSEPresentVoltage = Voltage measured at the EVSE outlet

- Error handling

None.

- Message Example

DC_WeldingDetectionReq


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_WeldingDetectionReq xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366048</p1:TimeStamp>
    </p1:Header>
    <p0:EVProcessing>Ongoing</p0:EVProcessing>
</p0:DC_WeldingDetectionReq>
```


DC_WeldingDetectionRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:DC_WeldingDetectionRes xmlns:p0="urn:iso:std:iso:15118:-20:DC"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366048</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
    <p0:EVSEPresentVoltage>
        <p1:Exponent xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">0</p1:Exponent>
        <p1:Value xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">300</p1:Value>
    </p0:EVSEPresentVoltage>
</p0:DC_WeldingDetectionRes>
```


6.11.4.15 SessionStopReq/Res

- General

SessionStopReq:

ChargingSession = Terminate

SessionStopRes:

ResponseCode = OK

NOTE: Pause and ServiceRenegotiate are not supported in this guide.

- Error handling

[ChIN-BPT-024] If ChargingSession = Pause or ServiceRenegotiate is sent in SessionStopReq by the EVCC, the SECC shall send corresponding SessionStopRes with ResponseCode = FAILED_xxx and terminate the charging session.

Related ISO 15118-20 requirements: **[V2G20-1955]**, **[V2G20-1195]**.

If the sessionStopReq is sent before WeldingDetection (pre-mature session termination), the usage of EVTerminationCode/Explanation is encouraged for debugging purposes.

Optional elements:

- EVTerminationCode: 80 string
- EVTerminationExplanation: 160 string

SessionStopReq


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:SessionStopReq xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366049</p1:TimeStamp>
    </p1:Header>
    <p0:ChargingSession>Terminate</p0:ChargingSession>
</p0:SessionStopReq>
```


SessionStopRes


```xml
<?xml version="1.0" encoding="UTF-8"?>
<p0:SessionStopRes xmlns:p0="urn:iso:std:iso:15118:-20:CommonMessages"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <p1:Header xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">
        <p1:SessionID>3933323835363733</p1:SessionID>
        <p1:TimeStamp>1624366049</p1:TimeStamp>
    </p1:Header>
    <p1:ResponseCode xmlns:p1="urn:iso:std:iso:15118:-20:CommonTypes">OK</p1:ResponseCode>
</p0:SessionStopRes>
```

6.11.4.16 General Error Handling

[ChIN-BPT-025] The responseCode in the following table shall be used according to the requirements in ISO 15118-20. The table is based on Table 224 in ISO 15118-20 with V2G messages which are used in this guide.

[ChIN-BPT-026] ISO 15118-20 **[V2G20-459]** shall apply.

Table 114 - General error handling

ResponseCode (Enumeration)	V2G Application Layer Protocol Handshake Messages			V2G Application Layer Messages					
	SessionSetupRes	ServiceDiscoveryRes	ServiceDetailRes	ServiceSelectionRes	AuthorizationSetupRes	AuthorizationRes	ScheduleExchangeRes	PowerDeliveryRes	SessionStopRes
OK	x	x	x	x	x	x	x	x	x
OK_NewSessionEstablished	x								
WARNING_AuthorizationSelectionInvalid						x			
WARNING_EIMAuthorizationFailure						x			
WARNING_StandbyNotAllowed								x	
FAILED	x	x	x	x	x	x	x	x	x
FAILED_SequenceError	x	x	x	x	x	x	x	x	x
FAILED_UnknownSession		x	x	x	x	x	x	x	x
FAILED_ServiceIDInvalid			x						
FAILED_ServiceSelectionInvalid				x					
FAILED_NoEnergyTransferServiceSelected				x					
FAILED_NoServiceRenegotiationSupported				x					x
FAILED_ContactorError								x	
FAILED_PowerDeliveryNotApplied								x	
FAILED_PauseNotAllowed									x

7. APPLICATION LAYER MESSAGE PROTOCOL

7.1 General Information and Definitions

A V2G message uses the EXI-based Presentation Layer as described in SAE J2931/1, Section 7. The communication between EVCC and SECC at application layer level is based on a client/server architecture. The EVCC always acts as a client (service requester) during the entire charging process, whereas the SECC always acts as a server (service responder). Hence the EVCC always initiates communication by sending a request message to the SECC which then returns the corresponding response message. All messages exchanged between EVCC and SECC are described with their syntax and their semantics in 6.2, 6.3, and 6.4. The entire XML Schema definition describing both V2G message sets is included in Appendix A.

Section 5.6.2 defines message timing and error handling for the V2G communication message exchange.

An example for a typical message sequence is shown in Appendix A.

V2G communication consists of two different message sets:

- V2G application layer protocol handshake messages (see 6.2)
- V2G application layer messages (refer to SAE J2931/4)

7.2 Protocol Handshake

7.2.1 Handshake Request-Response Message Pair

[V2G-DC-219] Before starting the application layer message exchange, an appropriate application layer protocol including its version shall be negotiated between the EVCC and the SECC.

In order to negotiate the protocol between the EVCC and the SECC, the following application layer protocol handshake is performed.

[V2G-DC-220] The EVCC shall initiate the handshake sending a SupportedAppProtocolReq message to the SECC. This request message provides a list of charging protocols supported by the EVCC.

[V2G-DC-221] Each entry in the list of supported EVCC protocols shall include the ProtocolNamespace, the VersionNumberMajor and VersionNumberMinor, the SchemaID dynamically assigned by the EVCC and the Priority of the protocol entry. The Priority in the EVCC request message enables the EVCC to announce the preferred application layer protocol where Pritory equal to 1 indicates the highest priority and Priority equal to 20 indicates the lowest priority. The number of protocols included in the request message is limited to 20.

[V2G-DC-222] The SECC shall respond with a supportedAppProtocolRes message indicating the protocol to be used for the subsequent message exchange by both the EVCC and the SECC.

[V2G-DC-223] The response message shall include a ResponseCode and the SchemaID of the protocol/schema which is agreed as application protocol for the following communication session. Thereby, the SECC shall select from its own list of supported protocols the protocol with highest Priority indicated by the EVCC.

[V2G-DC-224] The SECC shall confirm (positively respond) an EVCC supported protocol even if the values of the VersionNumberMinor in EVCC request message does not match with the VersionNumberMinor of an SECC supported protocol where the VersionNumberMajor matches.

NOTE: A higher value in the VersionNumberMinor indicates that (in comparison to a lower value) additional data elements will be transmitted from either the EVCC or SECC. Implementations only supporting the lower VersionNumberMinor value may not be able to process the data and may have to ignore this data; however, a difference in the VersionNumberMinor value between EVCC and SECC does not lead to an incompatibility. See 6.4 for examples of successful protocol negotiation.

[V2G-DC-225] All additional data element defined by the respective minor version shall be encoded as schema deviated case by the EXI coder (refer to EXI option settings in SAE J2931/4).

[V2G-DC-226] Usually it is expected that the SECC is able to support the relevant application layer protocols indicated by the EVCC. However when none of the application layer protocols included the list received from the EVCC is supported by the SECC, the ResponseCode in the response message shall be equal to Failed_NoNegotiation indicating that the protocol negotiation was not successful. In this error scenario, the response message shall not include a SchemaID.

[V2G-DC-227] If no successful protocol negotiation can be achieved the EVCC shall not initialize a V2G communication session.

[V2G-DC-228] This protocol handshake between EVCC and SECC shall be performed prior the actual V2G application layer message exchange. Only the message set defined in the agreed protocol shall be used in the V2G message flow except for minor deviations.

[V2G-DC-229] In the scope of SAE J2847-2 and DIN SPEC 70121, only the namespace "urn:din:70121:2012:MsgDef" and the version number 2.0 shall be used to indicate DIN SPEC 70121.

7.2.2 Message Definition supportedAppProtocolReq and supportedAppProtocolRes

[V2G-DC-230] The EVCC shall implement the message and message elements as in defined in Figure 46.

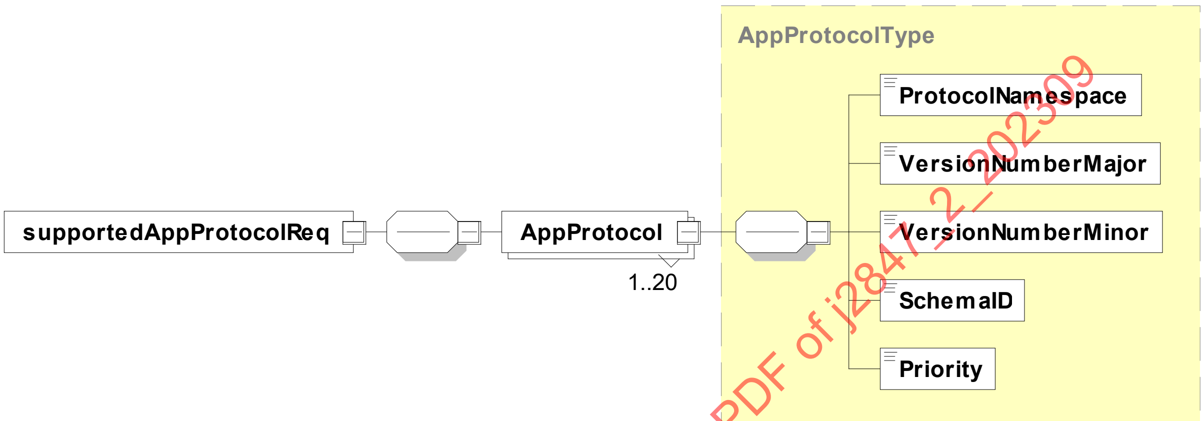


Figure 46 - Schema diagram—SupportedAppProtocolReq

[V2G-DC-231] The SECC shall implement the message and message elements as defined in Figure 47.

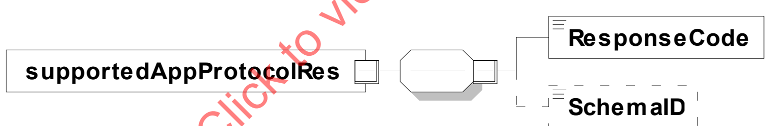


Figure 47 - Schema diagram—supportedAppProtocolRes

NOTE: See 7.1.1 for the XML schema code.

7.2.2.1 Semantics Description supportedAppProtocol Messages

[V2G-DC-233] The message elements defined in the supportedAppProtocol messages shall be used as defined in 4.2.

7.2.2.2 Message Examples

7.2.2.2.1 Protocol Prioritization

V2G message example 1 and V2G message example 2 illustrate the exchange of suppAppProtocol messages between the EVCC and the SECC. In the request message, the EVCC sends a prioritized list of supported application layer protocols to the SECC. In the response message the SECC confirms one protocol (with version 2.0) using a ResponseCode equal to "OK_SuccessfulNegotiation" and a schemaID equal to ten.

In the scope of DC charging, only the namespace "urn:din:70121:2012:MsgDef" and the major version number 2 and minor vesrion number 0 shall be used to indicate compatiblity with this version of the SAE J2847-2 document except for V2H and V2G described in Section 6 of this standard. The SAE namespace is also used for charging if connected to a bi-directional DC EVSE and V2H or V2G is not requested.

V2G Message Example 1 - supportedAppProtocolReq: Protocol Prioritization

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ns0:supportedAppProtocolReq xmlns:ns0="urn:iso:15118:2:2013:AppProtocol"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <AppProtocol>
        <ProtocolNamespace>urn:iso:15118:2:2013:MsgDef</ProtocolNamespace>
        <VersionNumberMajor>2</VersionNumberMajor>
        <VersionNumberMinor>0</VersionNumberMinor>
        <SchemaID>10</SchemaID>
        <Priority></Priority>
    </AppProtocol>
<AppProtocol>
        <ProtocolNamespace>urn:din:70121:2014:MsgDef</ProtocolNamespace>
        <VersionNumberMajor>2</VersionNumberMajor>
        <VersionNumberMinor>0</VersionNumberMinor>
        <SchemaID>20</SchemaID>
        <Priority>2</Priority>
    </AppProtocol>
</ns0:supportedAppProtocolReq>
```

V2G Message Example 2 - supportedAppProtocolRes: Protocol Prioritization

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ns0:supportedAppProtocolRes xmlns:ns0="urn:iso:15118:2:2013:AppProtocol"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <ResponseCode>OK_SuccessfulNegotiation</ResponseCode>
    <SchemaID>10</SchemaID>
</ns0:supportedAppProtocolRes>
```

7.2.2.2.2 Minor Deviation

V2G message example 3 and V2G message example 4 illustrate the exchange of suppAppProtocol messages between the EVCC and the SECC. In the request message, the EVCC sends just one supported application layer protocol (din:70121:2012 with version 1.0) to the SECC. The SECC supports protocol version 1.1 only. In the response message the SECC confirms protocol (din:70121:2012) with VersionNumberMajor equal to one using a schemaID equal to one. However, the ResponseCode is equal to OK_SuccessfulNegotiationWithMinorDeviation signalling that a minor version deviation applies. The EVCC may now expect message elements which aren't known by the EVCC but can be ignored.

V2G Message Example 3 - supportedAppProtocolReq: Deviation in Minor Version

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ns0:supportedAppProtocolReq xmlns:ns0="urn:iso:15118:2:2013:AppProtocol"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <AppProtocol>
        <ProtocolNamespace>urn:din:70121:2012:MsgDef</ProtocolNamespace>
        <VersionNumberMajor>2</VersionNumberMajor>
        <VersionNumberMinor>0</VersionNumberMinor>
        <SchemaID>1</SchemaID>
        <Priority>1</Priority>
    </AppProtocol>
</ns0:supportedAppProtocolReq>
```

V2G Message Example 4 - supportedAppProtocolRes: Deviation in Minor Version

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ns0:supportedAppProtocolRes xmlns:ns0="urn:iso:15118:2:2013:AppProtocol"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <ResponseCode>OK_SuccessfulNegotiationWithMinorDeviation</ResponseCode>
    <SchemaID>1</SchemaID>
</ns0:supportedAppProtocolRes>
```

7.3 Message Structure

7.3.1 Overview

Section 6.3 describes the messages of the V2G messages and their contents. It is divided into the following three subsections:

- V2G message definition (see 9.5.2)
- V2G message header definition (see 9.5.3)
- V2G message body definition (see 9.5.4)

The application layer message set is signalized by the XML schema namespace “sae:2847:2:2022:MsgDef.” See the XML schema definition in Appendix D for details concerning subnamespace definitions used for the message definition.

7.3.2 Message Definition

The schema is defined in the V2G application layer message.

[V2G-DC-234] The EVCC and the SECC shall implement the V2G message structure as defined in Figure 48.

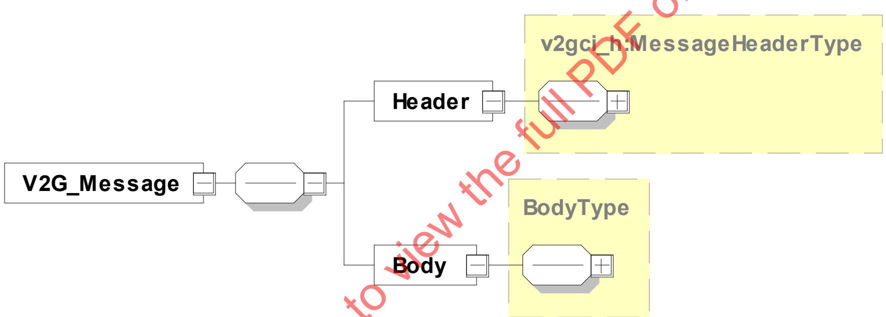


Figure 48 - Schema diagram—V2G message

[V2G-DC-235] The message elements of this message shall be used as defined in Table 115.

Table 115 - Semantics and type definition for a V2G message

Element Name	Type	Semantics
V2G_Message	complexType: Includes the message elements defined in this table	Root element that identifies this XML document as a V2G message. It contains two child elements, a Header and Body element.
Header	complexType: MessageHeaderType See 6.3.3	This element contains the content of the message header. It includes generic information for protocol flow and is not directly related to the semantics of each particular message defined in 6.4.
Body	complexType: BodyType See 6.3.4	This element contains the content of the message body. The message body provides the actual semantics of each message defined in 6.4.

V2G message example 1 shows an instance of a SessionSetupReq message. The header contains a SessionID equal to zero (0) because a new V2G communication session is about to being stated. The body contains the message specific content. In this case the message contains the message element EVCCID.

V2G Message Example 1 - Example for a SessionSetupReq Message

```
<?xml version="1.0" encoding="UTF-8"?>
<v2gci_d:V2G_Message xmlns:v2gci_b="urn:din:70121:2012:MsgBody"
 xmlns:xmlsig="http://www.w3.org/2000/09/xmldsig#"
 xmlns:v2gci_d="urn:din:70121:2012:MsgDef"
 xmlns:v2gci_t="urn:din:70121:2012:MsgDataTypes"
 xmlns:v2gci_h="urn:din:70121:2012:MsgHeader">
    <v2gci_d:Header>
        <v2gci_h:SessionInformation>
            <v2gci_t:SessionID>00</v2gci_t:SessionID>
        </v2gci_h:SessionInformation>
    </v2gci_d:Header>
    <v2gci_d:Body>
        <v2gci_b:SessionSetupReq>
            <v2gci_b:EVCCID>002412E2B490</v2gci_b:EVCCID>
        </v2gci_b:SessionSetupReq>
    </v2gci_d:Body>
</v2gci_d:V2G_Message>
```

7.3.3 Message Header Definition

The message header contains general information that is included in all messages. Figure 49 shows the schema definition of the V2G message header.

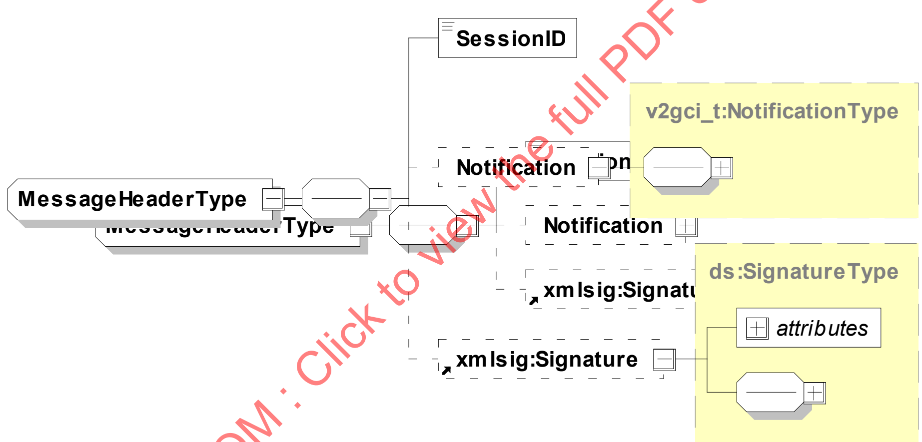


Figure 49 - Schema diagram—message header

[V2G-DC-236] The message elements of the message header shall be used as defined in Table 116.

Table 116 - Semantics and type definition for a V2G message header

Element Name	Type	Semantics
SessionID	simpleType: sessionIDType: hexBinary (max length: 8)	This message element is used by EVCC and SECC for uniquely identifying a V2G communication session. See 6.4.1.2.1 for requirements concerning this message element.
Notification	complexType: NotificationType,	Optional Element: NOTE: This optional element shall not be used.
Signature	--	Optional Element: NOTE: This optional element shall not be used.

[V2G-DC-548] The element “Signature” shall not be used.

[V2G-DC-619] The element “Notification” shall not be used.

NOTE: Please also see [V2G-DC-241] concerning the element “SessionID.”

7.3.4 Message Body Definition

The message body contains information details related to a specific message. Figure 50 shows the schema definition of the V2G message body. The messages described in the following section are derived from BodyBaseType, which represents the abstract message content (see 6.3.2). The different application messages are defined by the BodyElement and described in detail in 6.4.

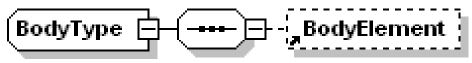


Figure 50 - Schema diagram—message body

[V2G-DC-237] The BodyElement shall be used as defined in Table 117.

Table 117 - Semantics and type definition for a V2G message body

Element Name	Type	Semantics
BodyElement	complexType: BodyBaseType, See 6.4	BodyElement is a head element of a substitution group and does not appear itself in an instance of a message. Instead one of the body elements defined in the substitution group in 6.4 is instantiated.

7.4 BodyElement Definitions

7.4.1 Common Messages

7.4.1.1 Overview

Messages defined as common messages can be applied to the message sequence in any charging mode defined in ISO/IEC 15118.

7.4.1.2 Session Setup

7.4.1.2.1 Session Setup Handling

After a connection has been established between the EVCC and the SECC the V2G communication session is established on application layer.

[V2G-DC-238] A V2G communication session shall be identified by a session identifier (session ID).

[V2G-DC-239] The SessionID shall not change during a V2G communication session.

[V2G-DC-241] The EVCC shall set SessionID equal to zero.

7.4.1.2.2 Session Setup Request

By using the SessionSetupReq message the PEV establishes a V2G communication session.

[V2G-DC-243] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 51.

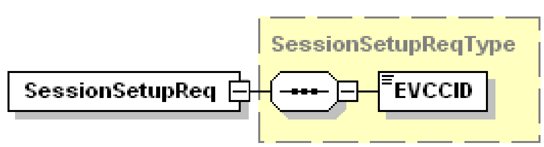


Figure 51 - Schema diagram—SessionSetupReq

[V2G-DC-244] The message elements of this message shall be used as defined in 4.2

7.4.1.2.3 Session Setup Response

By using the SessionSetupRes the SECC responds to an SessionSetupReq. With the SessionSetup Response the EVSE notifies the PEV with an enclosed response code, whether establishing a new session Session was successful or not.

[V2G-DC-245] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 52.

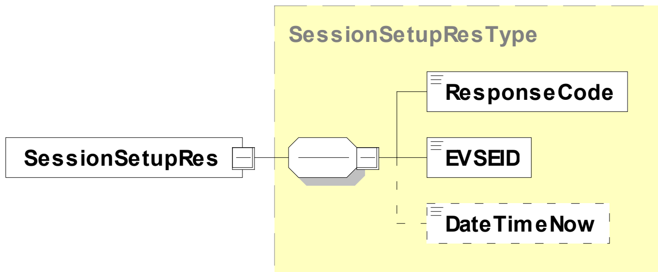


Figure 52 - Schema diagram—SessionSetupRes

[V2G-DC-246] The message elements of this message shall be used as defined in 4.2.

[V2G-DC-247] The SECC and the EVCC shall use the format for EVSEID as defined in DIN SPEC 91286.

[V2G-DC-620] The Power Outlet ID of DIN SPEC 91286 shall use the following pattern: <Power Outlet ID> = DIGIT * 31 (DIGIT/"*"):

[V2G-DC-621] To transform a string-based DIN SPEC 91286 EVSE ID to hexBinary representation and vice versa, the following conversion rules shall be used for each character and hex digit: "0" <--> 0x0, "1" <--> 0x1, "2" <--> 0x2, "3" <--> 0x3, "4" <--> 0x4, "5" <--> 0x5, "6" <--> 0x6, "7" <--> 0x7, "8" <--> 0x8, "9" <--> 0x9, "*" <--> 0xA, Unused <--> 0xB .. 0xF.

NOTE: Example: The DIN SPEC 91286 EVSE ID "49*89*6360" is represented as "0x49 0xA8 0x9A 0x63 0x60."

7.4.1.3 Service Discovery

7.4.1.3.1 Service Discovery Handling

The Service Discovery enables the EVCC to find all services provided by the EVSE**.** This document only describes relevant aspects of the V2G CI with regards to charging of the PEV. Nevertheless, the basis for discovery of future value added services is already considered and offers means for extensibility. Therefore, the Service Discovery differentiates between various service types and scopes.

7.4.1.3.2 Service Discovery Request

By sending the ServiceDiscoveryReq message, the EVCC triggers the SECC to send information about all services offered by the SECC. Furthermore, the EVCC can limit for particular services by using the service scope and service type elements.

[V2G-DC-248] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 53.

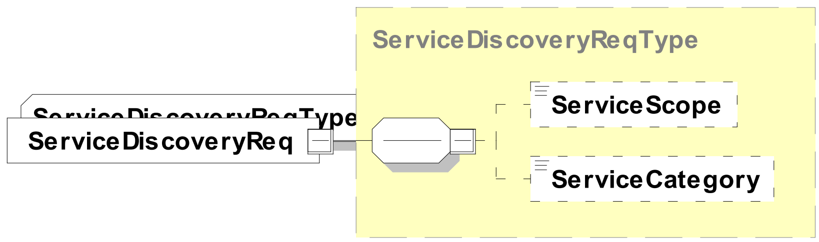


Figure 53 - Schema diagram—ServiceDiscoveryReq

[V2G-DC-249] The message elements of this message shall be used as defined 4.2.

[V2G-DC-557] If the optional element ServiceCategory is used, it shall always contain the value "EVcharging."

[V2G-DC-622] The optional element ServiceScope shall not be used.

7.4.1.3.3 Service Discovery Response

After receiving the ServiceDiscoveryReq message of the EVCC, the SECC sends the ServiceDiscoveryRes message. In case of a successful service discovery, the response lists all available services of the SECC for the defined criteria. In case the service discovery failed, the service list is empty and the response code indicates potential reasons.

[V2G-DC-250] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 54.

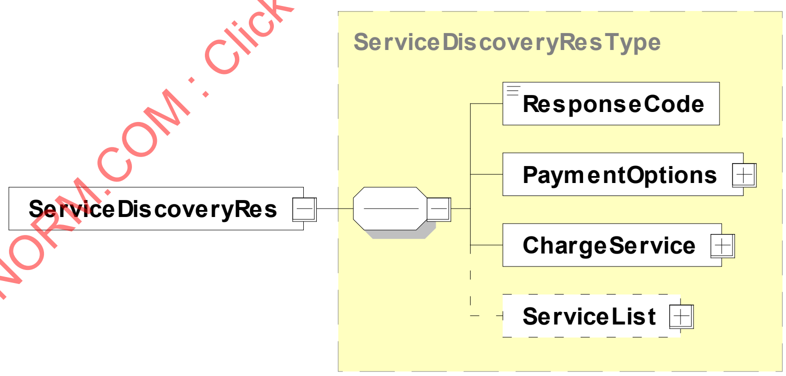


Figure 54 - Schema diagram—ServiceDiscoveryRes

[V2G-DC-251] The message elements of this message shall be used as defined in 4.2.

[V2G-DC-549] The element "ServiceList" shall not be used.

7.4.1.4 Service and Payment Selection

7.4.1.4.1 Service and Payment Selection Handling

Based on the provided services and the corresponding payment options by the SECC this message pair allows the transmission of the selected PaymentOption, SelectedServices and related ParameterSets.

[V2G-DC-252] Only the PaymentOption “ExternalPayment” shall be used, since detailed payment options are not defined.

7.4.1.4.2 Service and Payment Selection Request

This request message transports the information on the selected services and on how the all the selected services are paid.

[V2G-DC-253] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 55.

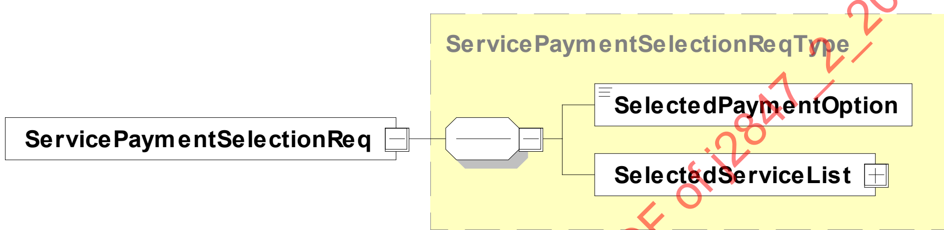


Figure 55 - Schema diagram—ServicePaymentSelectionReq

[V2G-DC-254] The message elements of this message shall be used as defined in 4.2.

7.4.1.4.3 Service and Payment Selection Response

With this message the SECC informs the EVCC whether the selected services and payment option were accepted.

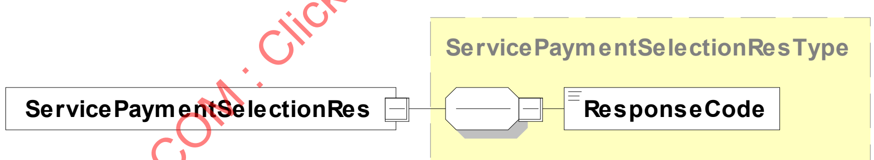


Figure 56 - Schema diagram—ServicePaymentSelectionRes

[V2G-DC-255] The message elements of this message shall be used as defined in 4.2.

7.4.1.5 Contract Authentication

7.4.1.5.1 Contract Authentication Request

[V2G-DC-481] The EVCC and the SECC shall implement the mandatory messages and message elements in Figure 57.

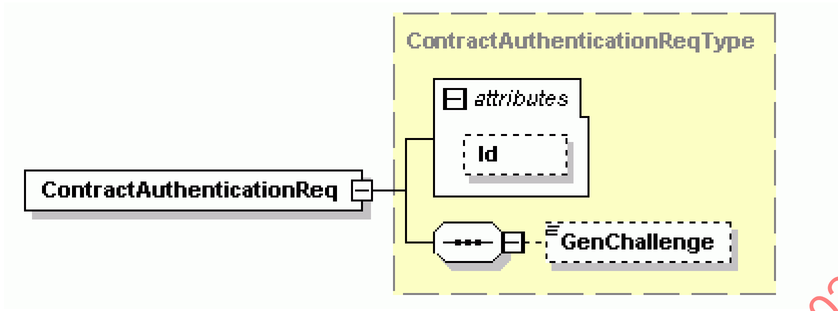


Figure 57 - Schema diagram—ContractAuthenticationReq

[V2G-DC-482] The message elements of this message shall be used as defined in 4.2.

[V2G-DC-550] The element “GenChallenge” shall not be used.

[V2G-DC-545] The element “Id” shall not be used.

7.4.1.5.2 Contract Authentication Response

[V2G-DC-483] The EVCC and the SECC shall implement the mandatory messages and message elements in Figure 58.

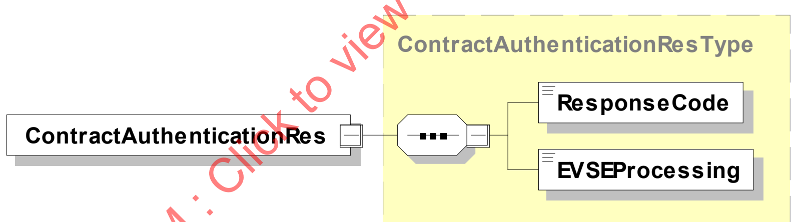


Figure 58 - Schema diagram—ContractAuthenticationRes

[V2G-DC-484] The message elements of this message shall be used as defined in 4.2.

NOTE: By using the EVSEProcessing parameter, the EVSE can indicate to the EVCC that the processing has not finished but a response message has to be sent to fulfil the timeout and performance requirements defined in 5.6.2. This allows to delay the V2G communication session while fulfilling the performance and timeout requirements.

7.4.1.6 Charge Parameter Discovery

7.4.1.6.1 Charge Parameter Discovery Handling

After being authorized for charging at the EVSE the EVCC sends a charge parameter discovery request message to the EVSE. This message provides status information about the PEV and furthermore provides parameters like estimated energy amounts for recharge and the point in time for the end of charge. In turn, the EVSE responds with its status information and provides currently applicable power output limits.

7.4.1.6.2 Charge Parameter Discovery Request

By sending the Charge Parameter Discovery Request message the EVCC provides its charging parameters to the SECC. This message provides status information about the PEV and additional charging parameters, like estimated energy amounts for recharge and the point in time for the end of charge.

[V2G-DC-256] The EVCC and the SECC shall implement the mandatory messages and message elements in Figure 59.

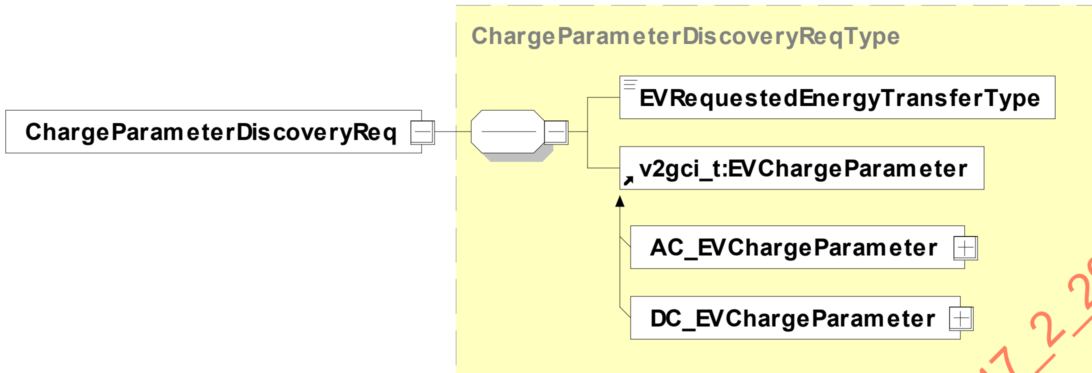


Figure 59 - Schema diagram—ChargeParameterDiscoveryReq

[V2G-DC-258] The message elements of this message shall be used as defined in 4.2.

[V2G-DC-551] The element “AC_EVChargeParameter” shall not be used.

The definition of EVRequestedEnergyTransferType supports connectors according to SAE J1772. Configuration CC (corresponding to SAE J1772 Type 1), IEC 62196-3 Configuration DD (corresponding to IEC 62196-2 Type 2), IEC 62196-3 Configuration EE, and IEC 62196-3 Configuration FF. Based on the supported connectors, the EVCC can choose the charging services as defined in 4.2.

[V2G-DC-259] The EVCC shall use the EVRequestedEnergyTransferType as described in 4.2.

[V2G-DC-397] The ChargeParameterDiscoveryRes message shall contain the ResponseCode “FAILED_WrongEnergyTransferType” if the content of element EVRequestedEnergyTransferType” in the ChargeParameterDiscoveryReq message is not valid, or does not match the content of the element EVChargeParameter.

[V2G-DC-623] If the EVCC requests DC charging using the extended pins of a vehicle connector according to SAE J1772 or IEC 62196-2 Configuration EE or Configuration FF, the EVCC shall transmit “DC_extended” in EVRequestedEnergyTransferType.

[V2G-DC-624] If the EVCC requests DC charging using the core pins of an connector according to SAE J1772 Configuration CC (corresponding to an IEC 62196-2 Type 1) or according to IEC 62196-3 Configuration DD (corresponding to an IEC 62196-2 Type 2), the EVCC shall transmit “DC_core” in EVRequestedEnergyTransferType.

[V2G-DC-625] The EVCC shall not transmit other values than “DC_extended” and “DC_core” in EVRequestedEnergyTransferType.

7.4.1.6.3 Charge Parameter Discovery Response

With the charge parameter discovery response message the SECC provides applicable charge parameters from the grid's perspective. Next to general charge parameters of the EVSE, this optionally includes further information on cost over time, cost over demand, cost over consumption or a combination of these. The term "cost" refers to any kind of cost specified in this version of the standard and is not limited to monetary costs. Based on this cost information the PEV may optimize its charge for the requested amount of energy.

[V2G-DC-260] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 60.

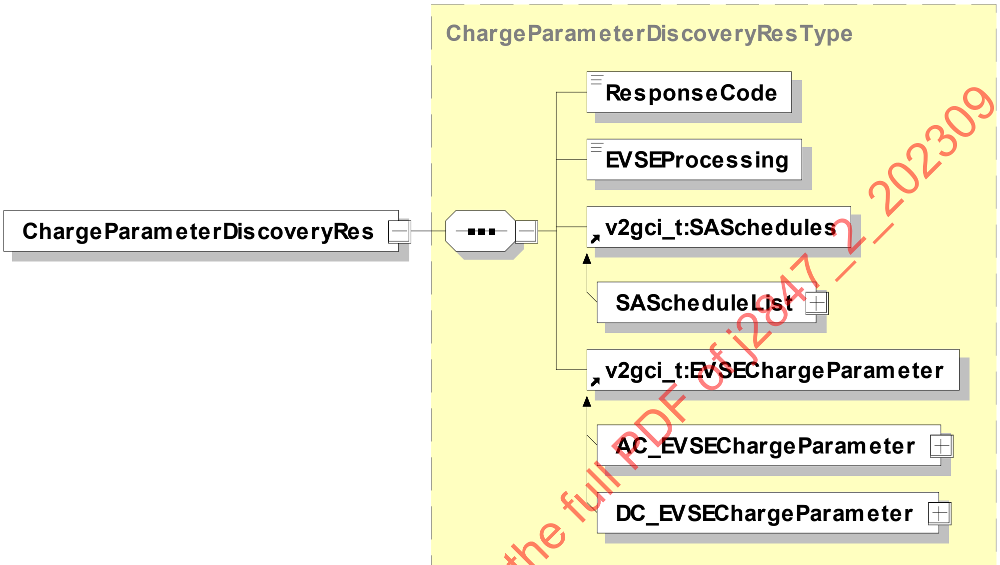


Figure 60 - Schema diagram—charge parameter discovery res

[V2G-DC-262] The message elements of this message shall be used as defined in 4.2.

NOTE: By using the EVSEProcessing parameter, the EVSE can indicate to the EVCC that the processing has not finished but a response message has to be sent to fulfil the timeout and performance requirements defined in 5.6.2. This allows to delay the V2G communication session while fulfilling the performance and timeout requirements.

[V2G-DC-552] The element "AC_EVSEChargeParameter" shall not be used.

[V2G-DC-626] The EVSE shall provide its maximum output power limit in the element "EVSEMaximumPowerLimit" of "DC_EVSEChargeParameter."

7.4.1.7 Power Delivery

7.4.1.7.1 Power Delivery Handling

The Power Delivery message exchange marks the point in time when the EVSE provides voltage to its connector and the PEV can start to charge its battery.

7.4.1.7.2 Power Delivery Request

By sending the power delivery request, the EVCC requests the EVSE to switch power on and transmits the charging profile it will follow during the charging process.

NOTE: The point in time this message is sent does not necessarily correlate with the start of the charging process. The onboard charger of the PEV may decide on the basis of its schedule when the charging process starts.

[V2G-DC-263] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 61.

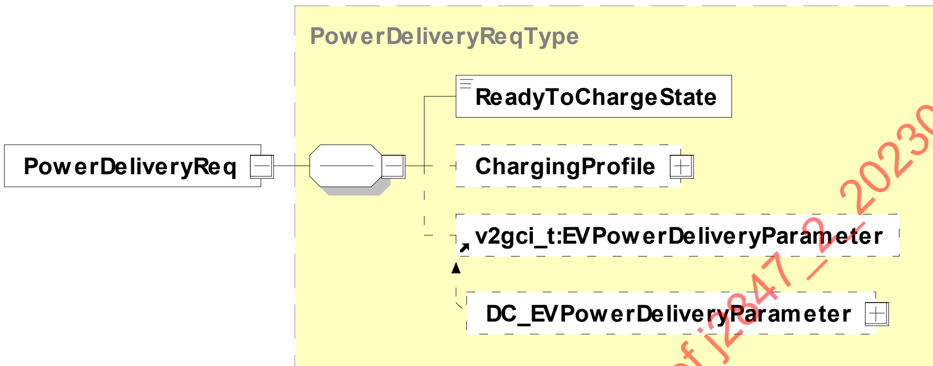


Figure 61 - Schema diagram—PowerDeliveryReq

[V2G-DC-264] The message elements of this message shall be used as defined in 4.2.

[V2G-DC-558] The optional element “DC_EVPowerDeliveryParameter” shall be used.

7.4.1.7.3 Power Delivery Response

After receiving the Power Delivery Request message of the EVCC, the SECC sends the Power Delivery Response message including information if power will be available.

[V2G-DC-265] The EVCC and the SECC shall implement the mandatory messages and message elements in Figure 62.

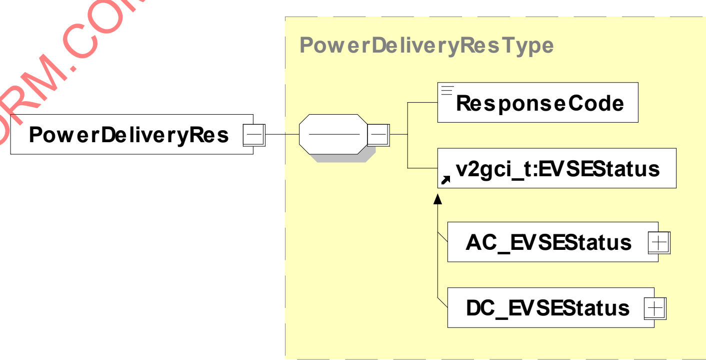


Figure 62 - Schema diagram—PowerDeliveryRes

[V2G-DC-266] The SECC shall always accept the ChargingProfile of the EVCC (see 4.2) if it does not exceed the PMax values of all PMaxScheduleEntry elements (see 4.2) according to the chosen SAScheduleTuple element (see 4.2) in the charge parameter discovery response message (see 6.4.1.6.3).

[V2G-DC-267] The SECC shall send the negative response code FAILED_ChargingProfileInvalid in the PowerDelivery response message if the EVCC sends a ChargingProfile (see 4.2) which is not adhering to the PMax values of all PMaxScheduleEntry elements (see 4.2) according to the chosen SAScheduleTuple element (see 4.2) in the charge parameter discovery response message (see 6.4.1.6.3).

[V2G-DC-268] The message elements of this message shall be used as defined in 4.2.

[V2G-DC-553] The element "AC_EVSEStatus" shall not be used.

7.4.1.8 Session Stop

7.4.1.8.1 Session Stop Handling

This V2G message pair shall be used for terminating a V2G communication session initated by preceding SessionSetupReq message.

7.4.1.8.2 Session Stop Request

By sending the Session Stop Request the EVCC requests termination of the V2G communication session.

[V2G-DC-287] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 63.

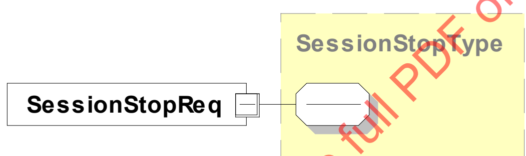


Figure 63 - Schema diagram—SessionStopReq

7.4.1.8.3 Session Stop Response

After receiving the Session Stop Request message of the EVCC, the SECC sends the Session Stop Response message informing the EVCC if terminating the V2G communication session was successful.

[V2G-DC-288] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 64.

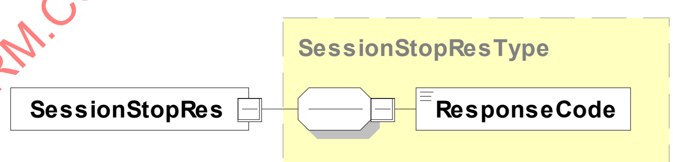


Figure 64 - Schema diagram—SessionStopRes

[V2G-DC-289] The message elements of this message shall be used as defined in 4.2.

7.4.2 DC-Messages

7.4.2.1 Overview

Messages defined as DC-Messages shall be applied to DC charging message sequence only.

7.4.2.2 Cable Check

7.4.2.2.1 Cable Check Handling

For a safe DC charging a cable check must be performed prior to charging.

[V2G-DC-269] For cable check details, refer to IEC 61851-23.

7.4.2.2.2 Cable Check Request

With the Cable Check Request, the EVCC asks the EVSE to perform a cable check, which includes an isolation test, before charging.

[V2G-DC-270] The EVCC and the SECC shall implement the mandatory messages and message elements in Figure 65.

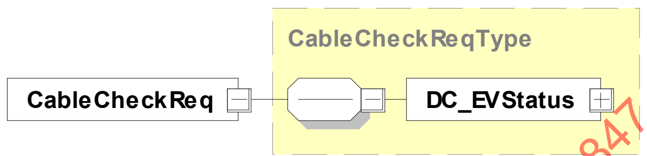


Figure 65 - Schema diagram—CableCheckReq

[V2G-DC-271] The message elements of this message shall be used as defined in 4.2.

7.4.2.2.3 Cable Check Response

After receiving the Cable Check Request message of the EVCC, the SECC sends the Cable Check Response message informing the EV about result of cable check and EVSE status.

[V2G-DC-272] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 66.

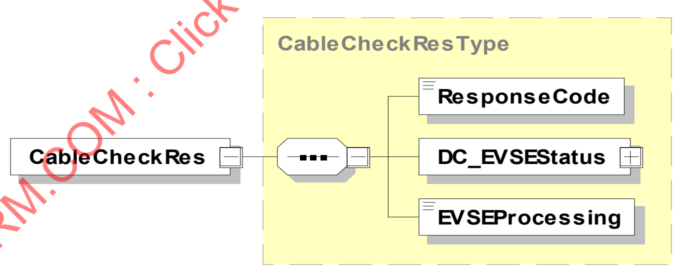


Figure 66 - Schema diagram—CableCheckRes

[V2G-DC-274] The message elements of this message shall be used as defined in 4.2.

NOTE: By using the EVSEProcessing parameter, the EVSE can indicate to the EVCC that the processing has not finished but a response message has to be sent to fulfil the timeout and performance requirements defined in 5.6.2. This allows to delay the V2G communication session while fulfilling the performance and timeout requirements.

7.4.2.3 Pre-Charge

7.4.2.3.1 Pre-Charge Handling

Pre-charge is used for adjusting the EVSE output voltage to the PEV RESS voltage in order to minimize the inrush current when the contactors of the PEV are being closed.

7.4.2.3.2 Pre-Charge Request

With the pre-charging request, the EVCC asks the EVSE to apply certain values for output voltage and output current. Since the contactors of the PEV are open during Pre-Charging, the actual current flow from the EVSE to the PEV will be very small, i.e., in most cases smaller than the requested output current. The PEV may use several pre-charging request/response message pairs in order to precisely adjust the EVSE output voltage to the PEV RESS voltage measured inside the PEV.

[V2G-DC-275] The EVCC and the SECC shall implement the mandatory messages and message elements in Figure 67.

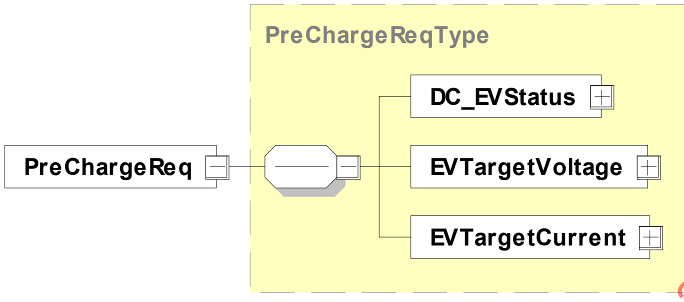


Figure 67 - Schema diagram—PreChargeReq

[V2G-DC-276] The message elements of this message shall be used as defined in 4.2.

7.4.2.3.3 Pre-Charge Response

After receiving the pre-charge request message of the EVCC, the SECC sends the pre-charge response message informing the EV about EVSE status and present EVSE output voltage.

[V2G-DC-277] The EVCC and the SECC shall implement the mandatory messages and message elements in Figure 68.

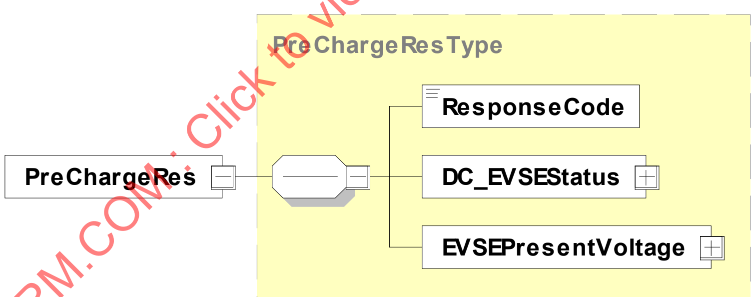


Figure 68 - Schema diagram—PreChargeRes

[V2G-DC-278] The message elements of this message shall be used as defined in 4.2.

7.4.2.4 Current Demand

7.4.2.4.1 Current Demand Handling

For DC charging control, cyclic exchange of requested current and voltage from PEV side is necessary.

7.4.2.4.2 Current Demand Request

By sending the current demand request the EVCC requests a certain current from EVSE. Also the target voltage and current are transferred.

[V2G-DC-279] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 69.

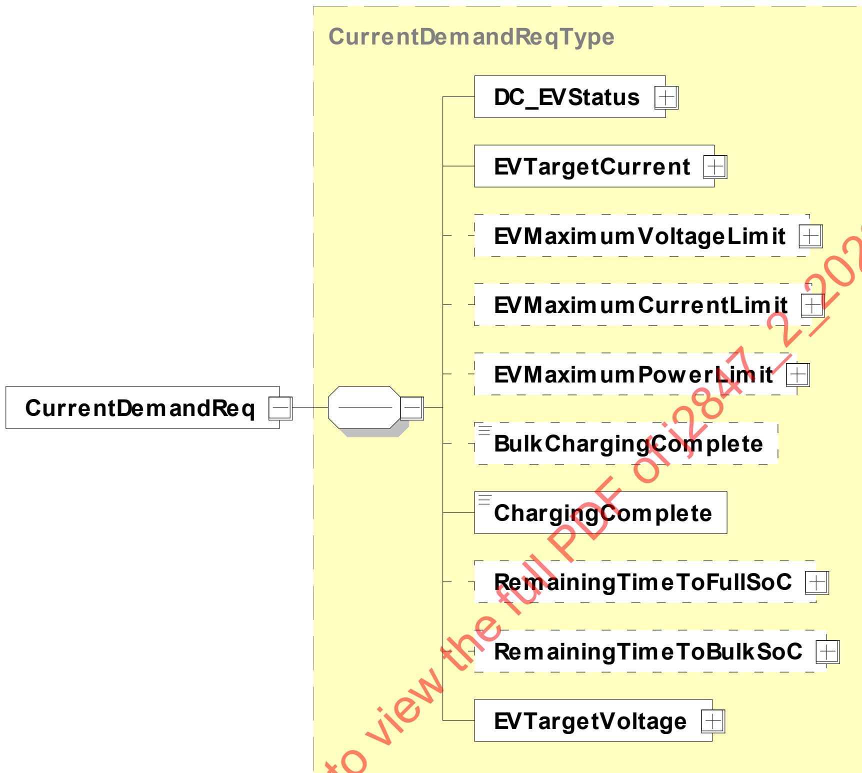


Figure 69 - Schema diagram—CurrentDemandReq

[V2G-DC-280] The message elements of this message shall be used as defined in 4.2.

NOTE 1: In accordance with [V2G-DC-641], the value of EVMaximumPowerLimit that is sent in any CurrentDemandReq message shall not exceed the value of EVMaximumPowerLimit that is sent in the ChargeParameterDiscoveryReq message.

NOTE 2: For details on the processing of "EVMaximumCurrentLimit" and "EVMaximumVoltageLimit" by the EVSE, please see 4.2.

7.4.2.4.3 Current Demand Response

After receiving the current demand request message of the EVCC, the SECC sends the current demand response message informing the EVCC about EVSE status and present EVSE output voltage and current.

[V2G-DC-281] The EVCC and the SECC shall implement the mandatory message and message elements in Figure 70.

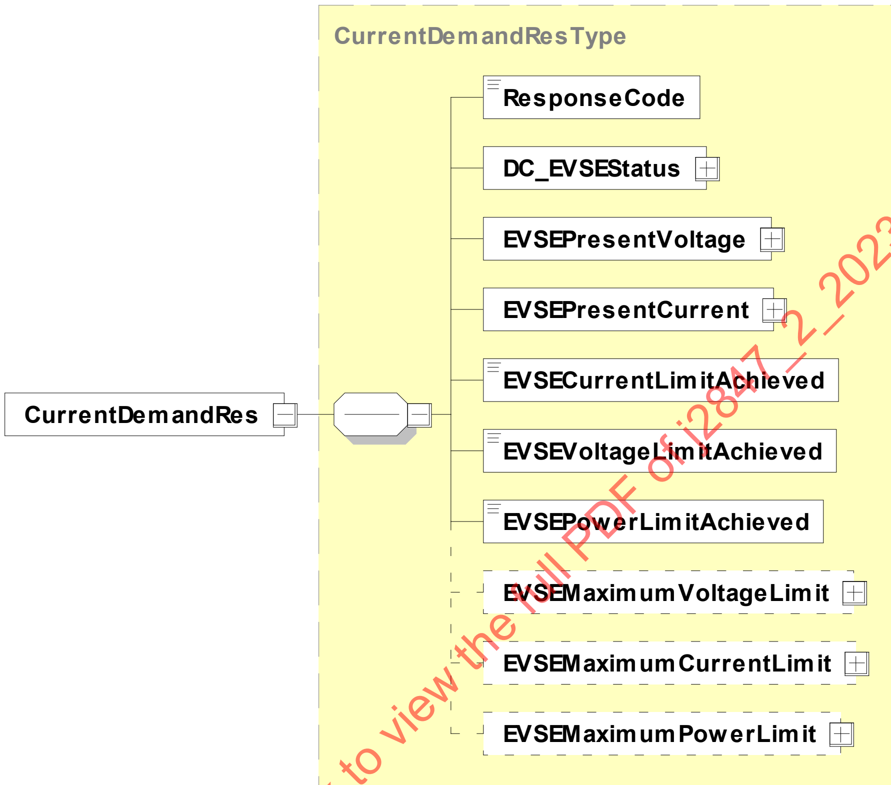


Figure 70 - Schema diagram—CurrentDemandRes

[V2G-DC-282] The message elements of this message shall be used as defined in 4.2.

7.4.2.5 Welding Detection

7.4.2.5.1 Welding Detection Handling

Since welded contactors impose a safety risk, the PEV may optionally perform a welding detection at the end of the charging sequence, prior to unlocking the connector. In order to detect welded contactors, the PEV steps through a sequence of independently opening and closing its two contactors while evaluating the voltage on the inlet side of the contactors in each step. It may use its own voltage measurement at the inlet or the voltage measurement of the EVSE at its output, or both.

7.4.2.5.2 Welding Detection Request

The EVCC sends the welding detection request to obtain from the EVSE the voltage value measured by the EVSE at its output.

[V2G-DC-283] The SECC shall implement the mandatory message and message elements in Figure 71. For the EVCC, it is optional to implement this message.

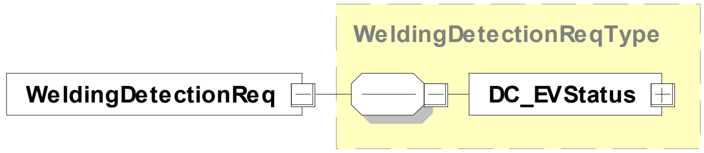


Figure 71 - Schema diagram—WeldingDetectionReq

[V2G-DC-284] The message elements of this message, if implemented, shall be used as defined in 4.2.

7.4.2.5.3 Welding Detection Response

After receiving the welding detection request message of the EVCC, the SECC sends the welding detection response message informing the EVCC about the EVSE status and the present EVSE output voltage.

[V2G-DC-285] The SECC shall implement the mandatory message and message elements in Figure 72. For the EVCC, it is optional to implement this message.

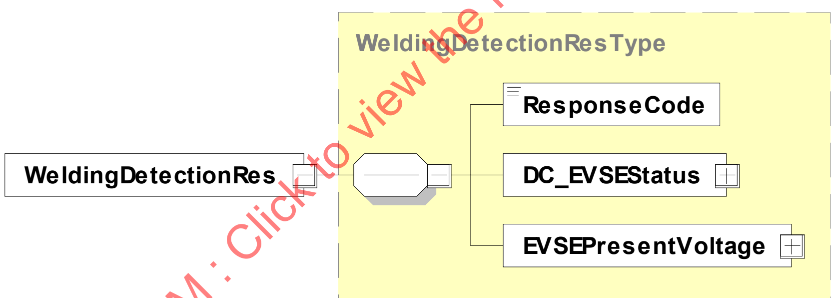


Figure 72 - Schema diagram—WeldingDetectionRes

[V2G-DC-286] The message elements of this message, if implemented, shall be used as defined in 4.2.

8. NOTES

8.1 Revision Indicator

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

8.2 Acknowledgement

SAE International acknowledges that original DIN SPEC 70121:2014, with DIN permission, was used in relevant parts of this SAE J2847/2 standard.

Section 6 is added for DC V2G/V2H and uses ISO 15118-2 schema with application software changes. No additional material from ISO 15118-2 is planned to be included in this standard.

PREPARED BY SAE HYBRID - EV COMMITTEE

APPENDIX A - MESSAGE SEQUENCE EXAMPLES

A.1 MESSAGE SEQUENCE EXAMPLE SUCCESSFUL DC CHARGING SESSION

This section gives an overview of the message flow between the PEV and EVSE during normal operation for a DC charging scenario. It does not provide an in depth view on message timings and other constraints. The sequence shown in Figures A1 to A4 gives a basic overview of the different communication phases and the respective message sequence. The contents of all messages are described in Section 7. For reasons of clarity and readability, the individual messages are represented just by the message name rather than including the complete data structure and data types.

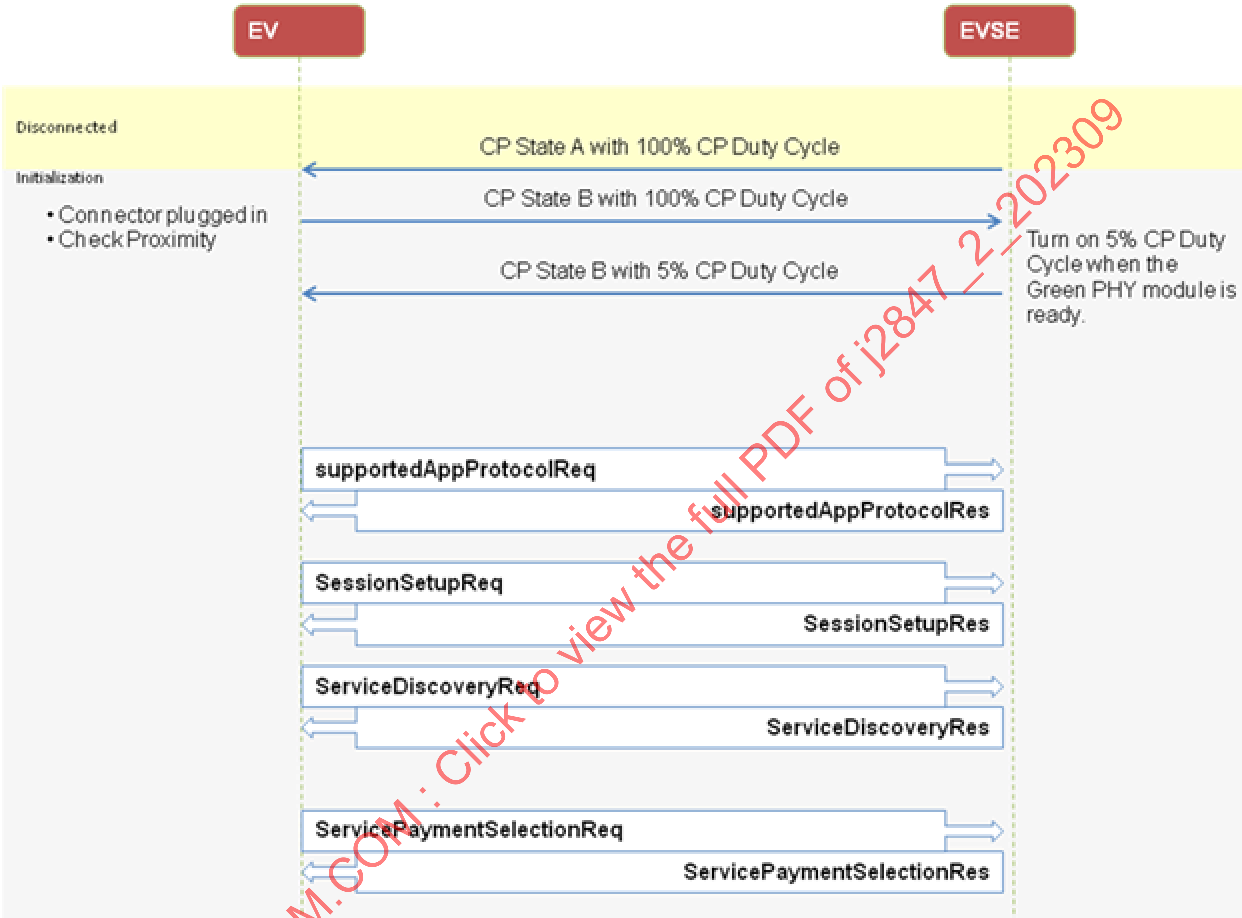


Figure A1 - Initialization sequence between PEV and EVSE

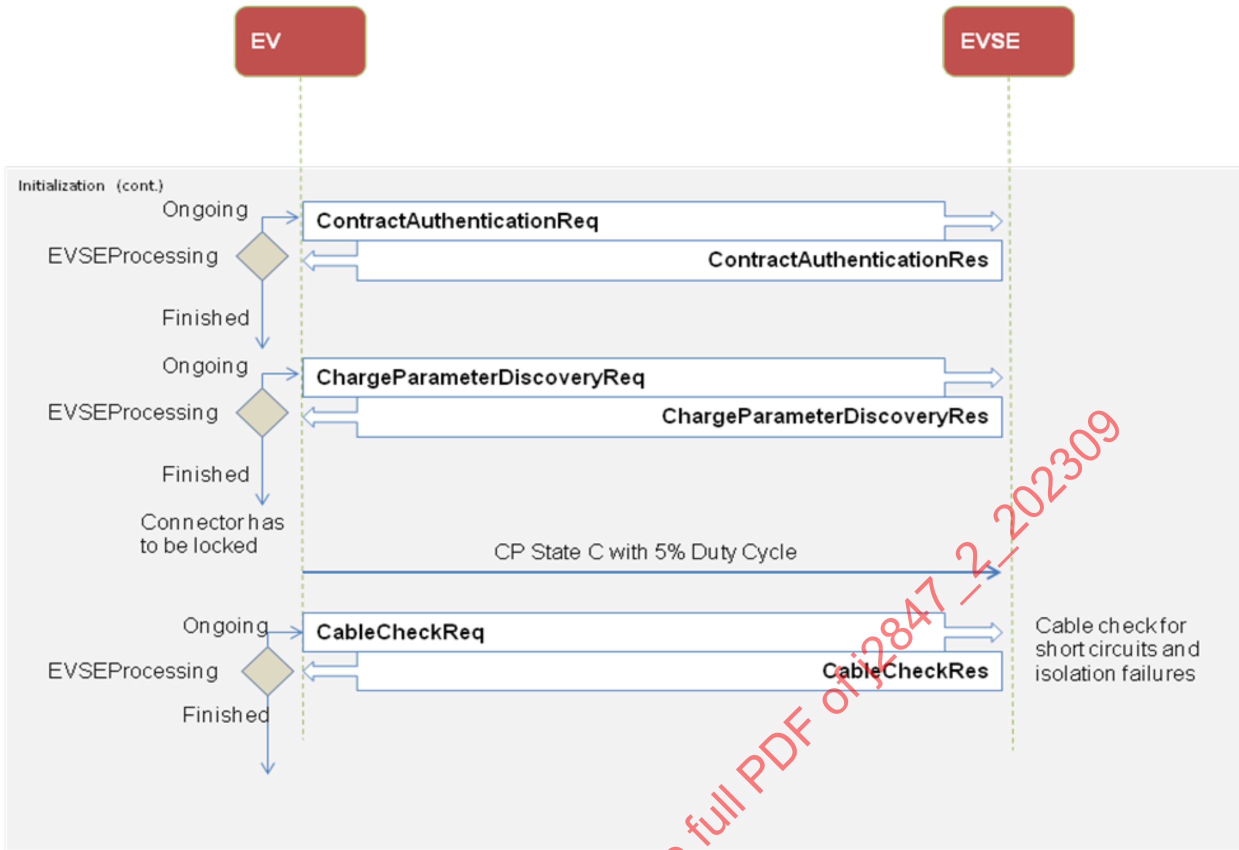


Figure A2 - Initialization sequence between PEV and EVSE (continued)

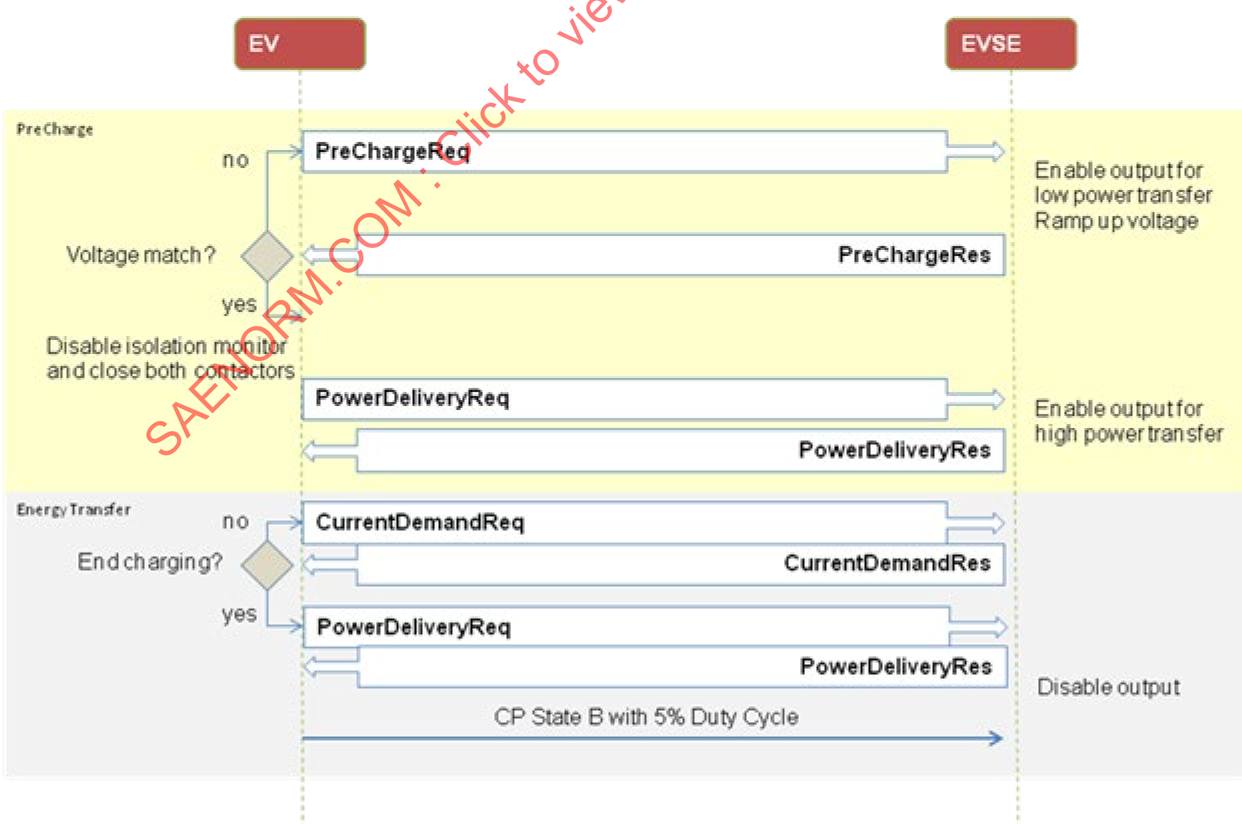
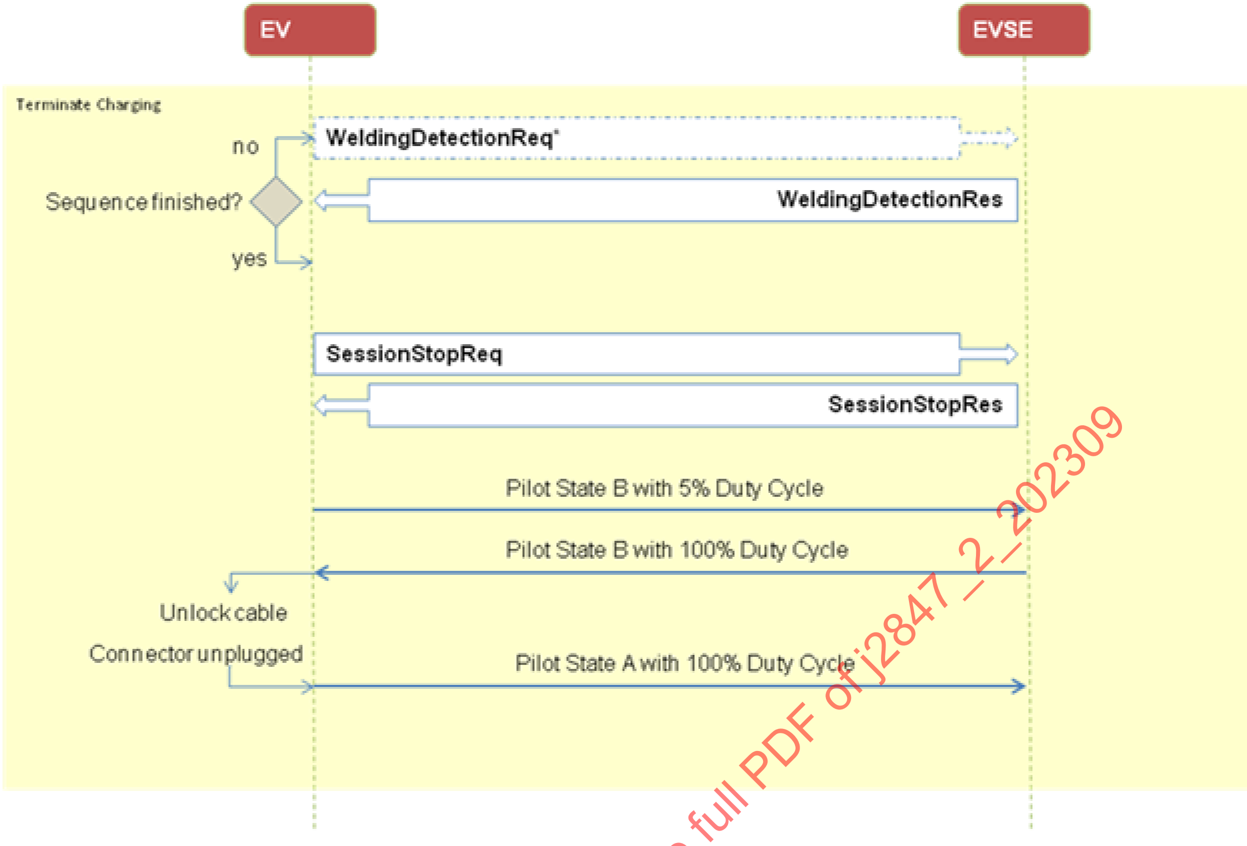


Figure A3 - Pre-charge and energy transfer sequence between PEV and EVSE



* for the EV, it is optional to perform a WeldingDetection

Figure A4 - Welding detection and terminate charging sequence between PEV and EVSE

APPENDIX B - SIGNALS TABLE

Table B1 - Signals table

	Signal	Source	Destination	Unit	Purpose	Default value	xml Name	xml Type
1	Bulk Charging Complete	EVCC	SECC	Boolean	Display	FALSE	BulkChargingComplete	Boolean
2	Bulk SOC	EVCC	SECC	%	Display	1	BulkSOC	percentValueType
3	Charge Service	SECC	EVCC	Complex	Initialization	0	Charge Service	ServiceChargeType
4	Charging Complete	EVCC	SECC	Boolean	Display	FALSE	ChargingComplete	Boolean
5	Charging Profile	EVCC	SECC	Complex	control	Null	ChargingProfile	ChargingProfileType
6	Charging Profile Entry Max Power	EVCC	SECC	value	control	0 Watts	ChargingProfileEntryMaxPower	PMaxType
7	Charging Profile Entry Start	EVCC	SECC	seconds	control	0	ChargingProfileEntryStart	unsignedInt
8	Contract (not used)	EVCC	SECC	enumeration	Display	Null	Contract	enumeration
9	Date Time Now	SECC	EVCC	value	Initialization	0	DateTimeNow	Long
10	DC EV Charge Parameter	EVCC	SECC	Complex	control	Null	DC_EVChargeParameter	DC_EVChargeParameterType
11	DC EV Power Delivery Parameter	EVCC	SECC	Complex	control	Null	DC_EVPowerDeliveryParameter	DC_EVPowerDeliveryParameterType
12	DC EV Status	EVCC	SECC	Complex	Safety & Display	EV_NotReady	DC_EVStatus	DC_EVStatusType
13	DC EVSE Charge Parameter	SECC	EVCC	Complex	control	Null	DC_EVPowerDeliveryParameter	DC_EVSEChargeParameterType
14	DC EVSE Status	SECC	EVCC	Complex	Safety & Display	EVSE_NotReady	DC_EVSEStatus	DC_EVSEStatusType
15	Duration	SECC	EVCC	value	control	600	Duration	unsignedInt
16	Energy Transfer Type	SECC	EVCC	Enumeration	Initialization	DC_Extended	EnergyTransferType	EVSESupportedEnergyTransferType
17	EV Cabin Conditioning	EVCC	SECC	Boolean	Display	FALSE	EVCabinConditioning	Boolean
18	EV Energy Capacity	EVCC	SECC	Wh	Display	1000 Wh	EVEnergyCapacity	PhysicalValueType
19	EV Energy Request	EVCC	SECC	Wh	Display	1000 Wh	EVEnergyRequest	PhysicalValueType
20	EV Error Code	EVCC	SECC	Enumeration	Display	NoData	EVErrorCode	DC_EVErrorCodeType
21	EV Maximum Current Limit	EVCC	SECC	A	Safety	0	EVMaximumCurrentLimit	PhysicalValueType
22	EV Maximum Power Limit	EVCC	SECC	W	Initialization	0 W	EVMaximumPowerLimit	PhysicalValueType
23	EV Maximum Voltage Limit	EVCC	SECC	V	Safety	0 V	EVMaximumVoltageLimit	PhysicalValueType
24	EV Ready	EVCC	SECC	Boolean	Display	0	EVReady	Boolean
25	EV Requested Energy Transfer Type	EVCC	SECC	Enumeration	Initialization	DC_Extended	EVRequestedEnergyTransfer	EVRequestedEnergyTransferType
26	EV RESS Conditioning	EVCC	SECC	Boolean	Display	FALSE	EVRESSConditioning	Boolean
27	EV RESS SOC	EVCC	SECC	%	Display	1	EVRESSSOC	percentValueType

	Signal	Source	Destination	Unit	Purpose	Default value	xml Name	xml Type
28	EV Target Current	EVCC	SECC	A	Safety	0	EVTargetCurrent	PhysicalValueType
29	EV Target Voltage	EVCC	SECC	V	Initialization	0 V	EVTargetVoltage	PhysicalValueType
30	EVCC ID	EVCC	SECC	value	Initialization	0	EVCCID	evccIDType
31	EVSE Current Limit Achieved	SECC	EVCC	Boolean	Control	FALSE	EVSECurrentLimitAchieved	Boolean
32	EVSE Current Regulation Tolerance	SECC	EVCC	A	Initialization	0	EVSECurrentRegulationTolerance	PhysicalValueType
33	EVSE Energy to be delivered	SECC	EVCC	Wh	Display	1000 Wh	EVSEEnergyToBeDelivered	PhysicalValueType
34	EVSE ID	SECC	EVCC	value	Initialization	0	EVSEID	evseIDType
35	EVSE Isolation Status	SECC	EVCC	Enumeration	Initialization	Invalid	EVSEIsolationStatus	isolationLevelType
36	EVSE Maximum Current Limit	SECC	EVCC	A	Safety	0	EVSEMaximumCurrentLimit	PhysicalValueType
37	EVSE Maximum Power Limit	SECC	EVCC	W	Initialization	0 W	EVSEMaximumPowerLimit	PhysicalValueType
38	EVSE Maximum Voltage Limit	SECC	EVCC	V	Safety	0 V	EVSEMaximumVoltageLimit	PhysicalValueType
39	EVSE Minimum Current Limit	SECC	EVCC	A	Safety	0	EVSEMinimumCurrentLimit	PhysicalValueType
40	EVSE Minimum Voltage Limit	SECC	EVCC	V	Safety	0 V	EVSEMinimumVoltageLimit	PhysicalValueType
41	EVSE Notification	SECC	EVCC	text string	Control	StopCharging	EVSENotification	EVSENotificationType
42	EVSE Peak Current Ripple	SECC	EVCC	A	Initialization	0	EVSEPeakCurrentRipple	PhysicalValueType
43	EVSE Power Limit Achieved	SECC	EVCC	Boolean	Control	FALSE	EVSEPowerLimitAchieved	Boolean
44	EVSE Present Current	SECC	EVCC	A	Diagnostics	FALSE	EVSEPresentCurrent	PhysicalValueType
45	EVSE Present Voltage	SECC	EVCC	V	Diagnostics	0	EVSEPresentVoltage	PhysicalValueType
46	EVSE Processing	SECC	EVCC	text string	control	Null	EVSEProcessing	EVSEProcessingType
47	EVSE Status Code	SECC	EVCC	text string	control	EVSE_NotReady	EVSEStatusCode	DC_EVSEStatusCodeType
48	EVSE Voltage Limit Achieved	SECC	EVCC	Boolean	Control	FALSE	EVSEVoltageLimitAchieved	Boolean
49	Free Service	SECC	EVCC	Boolean	control	FALSE	FreeService	boolean
50	Full SOC	EVCC	SECC	%	Display	1	FullSOC	percentValueType
51	General Challenge (not used)	EVCC	SECC	text string	Display	null	GenChallenge	genChallengeType
52	ID (not used)	EVCC	SECC	value	control	0	ID	IDREF
53	Notification Max Delay	SECC	EVCC	seconds	control	start with 2 secs Discuss with team	NotificationMaxDelay	unsignedInt
54	P Max	SECC	EVCC	Watts	control	500 watts	PMax	PMaxType
55	P Max Schedule	SECC	EVCC	Complex	control	null	PMaxSchedule	PMaxScheduleType
56	P Max Schedule Entry	SECC	EVCC	Complex	control	null	PMaxScheduleEntry	PMaxScheduleEntryType
57	P Max Schedule ID	SECC	EVCC	value	control	null	PMaxScheduleID	SAIDType (short)

	Signal	Source	Destination	Unit	Purpose	Default value	xml Name	xml Type
58	Parameter Set ID (not used)	EVCC	SECC	value	Control	?	ParameterSetID	short
59	Payment Option	SECC	EVCC	String	Initialization	Contract	SelectedPaymentOption	paymentOptionType
60	Priority	EVCC	SECC	value	Initialization	0	Priority	priorityType
61	Profile Entry	EVCC	SECC	Complex	control	null	ProfileEntry	ProfileEntryType
62	Protocol Namespace	EVCC	SECC	anyURI	Initialization	url	ProtocolNamespace	protocolNamespaceType
63	Ready To Charge State	EVCC	SECC	Boolean	Control	FALSE	ReadyToChargeState	Boolean
64	Relative Time Interval	SECC	EVCC	Complex	control	null	RelativeTimeInterval	RelativeTimeIntervalType
65	Remaining Time to Bulk SOC	EVCC	SECC	seconds	Display	0 sec	RemainingTimeToBulkSOC	PhysicalValueType
66	Remaining Time to Full SOC	EVCC	SECC	seconds	Display	0 sec	RemainingTimeToFullSOC	PhysicalValueType
67	Response Code	SECC	EVCC	Enumeration	Control	NoData	EVErrorCode	DC_EVErrorCodeType
68	SA Schedule List	SECC	EVCC	Complex	Initialization	0	SAScheduleList	SAScheduleListType
69	SA Schedule Tuple	SECC	EVCC	Complex	control	null	SAScheduleTuple	SAScheduleTupleType
70	SA Schedule Tuple ID	EVCC	SECC	value	control	1	SAScheduleTupleID	SAScheduleTupleType
71	SA Schedule Tuple ID	SECC	EVCC	value	control	0	SAScheduleTupleID	SAScheduleTupleType
72	Schema ID	SECC	EVCC	value	Initialization	0	SchemaID	idType
73	Schema ID	EVCC	SECC	value	Initialization	0	SchemaID	idType
74	Selected Payment Option (not used)	EVCC	SECC	String	Initialization	Contract	SelectedPaymentOption	paymentOptionType
75	Selected Service (not used)	EVCC	SECC	Complex	control	null	SelectedService	SelectedServiceType
76	Selected Service List (not used)	EVCC	SECC	Complex	control	null	SelectedServiceList	SelectedServiceListType
77	Service Category	EVCC	SECC	text string	control	EVCharging	ServiceCategory	serviceCategoryType
78	Service Category	SECC	EVCC	text string	control	ContractCertificate	ServiceCategory	serviceCategoryType
79	Service Charge Type	SECC	EVCC	Complex	control	null	ChargeService	ServiceChargeType
80	Service ID (not used)	EVCC	SECC	value	control	?	ServiceID	serviceIDType
81	Service ID (not used)	SECC	EVCC	value	control	?	ServiceID	serviceIDType
82	Service List	SECC	EVCC	Complex	control	null	ServiceList	ServiceTagListType
83	Service Name	SECC	EVCC	text string	Display	Null	ServiceName	serviceNameType
84	Service Scope	EVCC	SECC	text string	Display	Null	ServiceScope	serviceScopeType
85	Service Scope	SECC	EVCC	text string	Display	Null	ServiceScope	serviceScopeType
86	Service Tag	SECC	EVCC	Complex	control	null	ServiceTag	ServiceTagType
87	Start	SECC	EVCC	value	control	0	start	unsignedInt
88	Version Number Major	EVCC	SECC	value	Initialization	0	VersionNumberMajor	unsignedInt
89	Version Number Minor	EVCC	SECC	value	Initialization	0	VersionNumberMinor	unsignedInt

APPENDIX C - RESPONSE CODE CORRELATION MATRIX

Table C1 - Response code correlation matrix

Response Code	Response Message																	
	supportedAppProtocolRes	SessionSetupRes	ServicerDiscoveryRes	ServiceDetailRes	ServiceandPaymentSelectionRes	PaymentDetailsRes	ContractAuthenticationRes	ChargeParameterDiscoveryRes	PowerDeliveryRes	ChargingStatusRes	MeteringReceiptRes	CertificateUpdateRes	CertificateinstallationRes	CableCheckRes	PreChargingRes	CurrentDemandRes	WeldingDetectionRes	SessionStopRes
OK	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
OK_CertificateExpiresSoon																		
OK_NewSessionEstablished		X																
OK_OldSessionJoined		X																
FAILED	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FAILED_SequenceError	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FAILED_SignatureError	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	x
FAILED_UnknownSession			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FAILED_ServiceIDInvalid				X														
FAILED_PaymentSelectionInvalid					X													
FAILED_ServiceSelectionInvalid					X													
FAILED_CertificateExpired						X						X	X					
FAILED_NoCertificateAvailable													X					
FAILED_CertChainError												X						
FAILED_ContractCanceled												X						
FAILED_ChallengeInvalid							X											
FAILED_WrongEnergyTransferType								X										
FAILED_WrongChargeParameter								X										
FAILED_ChargingProfileInvalid									X									
FAILED_TariffSelectionInvalid									X									
FAILED_EVSEPresentVoltageToLow																		
FAILED_PowerDeliveryNotApplied									X									
FAILED_MeteringSignatureNotValid											X							

NOTE: Messages and Response Codes that are not used for DC charging according to this spec are marked in gray in Table C1.

APPENDIX D - REQUIREMENTS SUMMARY

The following table is intended to cross reference the content of DIN 70121 to J2847/2, J2931/1 and J2931/4.

Table D1 - Cross reference the content of DIN 70121 to SAE J2847/2, SAE J2931/1, and SAE J2931/4

	DIN Sections	Description	Rqmt	SAE J2847/2		SAE J2931/1		SAE J2931/4	
1	6.2.2	Applicability	**[V2G-DC-001]**	4.1.3.2	Applicability			4.3.2	Applicability
2	6.2.2	Applicability	**[V2G-DC-002]**	4.1.3.2	Applicability			4.3.2	Applicability
3	6.2.3	Usage of RFC references	**[V2G-DC-003]**	4.1.3.3	Usage of RFC references			4.3.3	Usage of RFC references
4	6.2.3	Usage of RFC references	**[V2G-DC-004]**	4.1.3.3	Usage of RFC references			4.3.3	Usage of RFC references
5	8.3.1.1.1	Basic Signaling	**[V2G-DC-005]**	4.1.1	Message sequences				
6	8.3.1.1.1	Basic Signaling	**~~[V2G-DC-006]~~**						
7	8.3.1.1.2	High-Level Communication (HLC)	**~~[V2G-DC-008]~~**						
8	8.3.3.2	Initialization of the Matching process	**[V2G-DC-014]**					9.2	Initialization of the matching process
9	8.3.3.2	Initialization of the Matching process	**[V2G-DC-018]**					9.2	Initialization of the matching process
10	8.3.3.2	Initialization of the Matching process	**[V2G-DC-019]**					9.2	Initialization of the matching process
11	8.3.3.2	Initialization of the Matching process	**[V2G-DC-020]**					9.2	Initialization of the matching process
12	8.3.1.4.2.1	Inter System Protocol (ISP)	**[V2G-DC-021]**					7.2.1	Inter System Protocol (ISP)
13	8.3.3.2	Initialization of the Matching process	**[V2G-DC-024]**					9.2	Initialization of the matching process
14	8.3.3.3	Discovery of the connected Green PHY node on EVSE side	**[V2G-DC-029]**					9.3	Discovery of the connected Green PHY node on EVSE side
15	8.3.3.3	Discovery of the connected Green PHY node on EVSE side	**[V2G-DC-030]**					9.3	Discovery of the connected Green PHY node on EVSE side
16	8.3.3.3	Discovery of the connected Green PHY node on EVSE side	**[V2G-DC-031]**					9.3	Discovery of the connected Green PHY node on EVSE side

	DIN Sections	Description	Rqmt	SAE J2847/2		SAE J2931/1		SAE J2931/4	
17	8.3.3.3	Discovery of the connected Green PHY node on EVSE side	**[V2G-DC-032]**					9.3	Discovery of the connected Green PHY node on EVSE side
18	8.3.3.3	Discovery of the connected Green PHY node on EVSE side	**[V2G-DC-034]**					9.3	Discovery of the connected Green PHY node on EVSE side
19	8.3.3.3	Discovery of the connected Green PHY node on EVSE side	**[V2G-DC-035]**					9.3	Discovery of the connected Green PHY node on EVSE side
20	8.3.3.3	Discovery of the connected Green PHY node on EVSE side	**[V2G-DC-038]**					9.3	Discovery of the connected Green PHY node on EVSE side
21	8.3.3.3.2	MME Content for SLAC	**[V2G-DC-042]**					9.3.2	MME Content for SLAC
22	8.3.3.4	Validation of the Matching EV - EVSE	**~~[V2G-DC-043]~~**						
23	8.3.3.4	Validation of the Matching EV - EVSE	**~~[V2G-DC-049]~~**						
24	8.3.3.4	Validation of the Matching EV - EVSE	**~~[V2G-DC-051]~~**						
25	8.3.3.4	Validation of the Matching EV - EVSE	**~~[V2G-DC-053]~~**						
26	8.3.3.4	Validation of the Matching EV - EVSE	**~~[V2G-DC-056]~~**						
27	8.3.3.4	Validation of the Matching EV - EVSE	**~~[V2G-DC-058]~~**						
28	8.3.3.5.1	Requirements	**[V2G-DC-059]**					9.3.3.1	Requirements
29	8.3.3.5.1	Requirements	**[V2G-DC-060]**					9.3.3.1	Requirements
30	8.3.3.5.1	Requirements	**[V2G-DC-061]**					9.3.3.1	Requirements
31	8.3.3.5.2	Amplitude Map exchange	**[V2G-DC-064]**					9.3.3.2	Amplitude Map exchange
32	8.3.3.6	Leave the Logical Network	**[V2G-DC-065]**					9.3.3.3	Leave the Logical Network
33	8.3.7.2	General drawing for Green PHY injection	**[V2G-DC-071]**					10.2	General drawing for Green PHY injection
34	8.3.7.2	General drawing for Green PHY injection	**[V2G-DC-072]**					10.2	General drawing for Green PHY injection

	DIN Sections	Description	Rqmt	SAE J2847/2		SAE J2931/1		SAE J2931/4	
35	8.3.7.2	General drawing for Green PHY injection	**[V2G-DC-075]**					10.2	General drawing for Green PHY injection
36	8.3.7.2	General drawing for Green PHY injection	**[V2G-DC-076]**					10.2	General drawing for Green PHY injection
37	8.3.7.2	General drawing for Green PHY injection	**[V2G-DC-077]**					10.2	General drawing for Green PHY injection
38	8.3.7.2	General drawing for Green PHY injection	**[V2G-DC-078]**					10.2	General drawing for Green PHY injection
39	8.3.7.3	Signal requirement for Green PHY injection	**[V2G-DC-081]**					10.3	Signal requirement for Green PHY injection
40	8.3.7.6.1	Overview	**[V2G-DC-088]**					10.6.1	Overview
41	8.4.1	V2G communication of the EVCC	**[V2G-DC-096]**			7.5	V2G communication states		
42	8.4.1	V2G communication of the EVCC	**[V2G-DC-097]**			7.5	V2G communication states		
43	8.4.1	V2G communication of the EVCC	**[V2G-DC-098]**			7.5	V2G communication states		
44	8.4.1	V2G communication of the EVCC	**[V2G-DC-100]**			7.5	V2G communication states		
45	8.4.1	V2G communication of the EVCC	**[V2G-DC-101]**			7.5	V2G communication states		
46	8.4.1	V2G communication of the EVCC	**[V2G-DC-102]**			7.5	V2G communication states		
47	8.4.1	V2G communication of the EVCC	**[V2G-DC-103]**			7.5	V2G communication states		
48	8.4.1	V2G communication of the EVCC	**[V2G-DC-105]**			7.5	V2G communication states		
49	8.4.1	V2G communication of the EVCC	**[V2G-DC-106]**			7.5	V2G communication states		
50	8.4.1	V2G communication of the EVCC	**[V2G-DC-107]**			7.5	V2G communication states		

	DIN Sections	Description	Rqmt	SAE J2847/2		SAE J2931/1		SAE J2931/4	
51	8.4.2	V2G communication of the SECC	**[V2G-DC-108]**			7.5	V2G communication states		
52	8.4.2	V2G communication of the SECC	**[V2G-DC-109]**			7.5	V2G communication states		
53	8.4.2	V2G communication of the SECC	**[V2G-DC-110]**			7.5	V2G communication states		
54	8.4.2	V2G communication of the SECC	**[V2G-DC-112]**			7.5	V2G communication states		
55	8.4.2	V2G communication of the SECC	**[V2G-DC-113]**			7.5	V2G communication states		
56	8.4.2	V2G communication of the SECC	**[V2G-DC-115]**			7.5	V2G communication states		
57	8.4.2	V2G communication of the SECC	**[V2G-DC-116]**			7.5	V2G communication states		
58	8.5.2	Applicable RFCs and Limitations and Protocol Parameter Settings	**[V2G-DC-117]**			7.6.2			
59	8.5.2.1	IPv6	**[V2G-DC-118]**			7.6.2.1			
60	8.5.2.1	IPv6	**[V2G-DC-119]**			7.6.2.1			
61	8.5.2.1	IPv6	**[V2G-DC-120]**			7.6.2.1			
62	8.5.2.1	IPv6	**[V2G-DC-121]**			7.6.2.1			
63	8.5.2.1	IPv6	**[V2G-DC-122]**			7.6.2.1			
64	8.5.2.1	IPv6	**[V2G-DC-123]**			7.6.2.1			
65	8.5.2.1	IPv6	**[V2G-DC-124]**			7.6.2.1			
66	8.5.2.1	IPv6	**[V2G-DC-125]**			7.6.2.1			
67	8.5.2.1	IPv6	**[V2G-DC-126]**			7.6.2.1			
			[V2G3-A09-126]					9.3.6	General error handling and timing constraints
68	8.5.2.2	Neighbour Discovery (ND)	**[V2G-DC-127]**			7.6.2.2			
			[V2G3-A09-127]					9.3.6	General error handling and timing constraints
69	8.5.2.2	Neighbour Discovery (ND)	**[V2G-DC-128]**			7.6.2.2			
70	8.5.2.3	Internet Control Message Protocol (ICMP)	**[V2G-DC-129]**			7.6.2.3			
71	8.5.2.3	Internet Control Message Protocol (ICMP)	**[V2G-DC-130]**			7.6.2.3			

	DIN Sections	Description	Rqmt	SAE J2847/2		SAE J2931/1		SAE J2931/4	
72	8.5.2.3	Internet Control Message Protocol (ICMP)	**[V2G-DC-133]**			7.6.2.3			
73	8.5.3.2	Stateless auto address configuration (SLAAC)	**[V2G-DC-134]**			7.6.3.2			
74	8.5.3.2	Stateless auto address configuration (SLAAC)	**[V2G-DC-135]**			7.6.3.2			
75	8.5.3.2	Stateless auto address configuration (SLAAC)	**[V2G-DC-136]**			7.6.3.2			
76	8.5.3.3	Address selection	**[V2G-DC-137]**			7.6.3.3			
77	8.5.5	SECC discovery	**[V2G-DC-138]**			7.6.5			
78	8.6.1.2	Applicable RFCs, Limitations and Protocol Parameter Settings	**[V2G-DC-139]**			7.7.1.2			
79	8.6.1.3	TCP Performance and Checksum Recommendations and Requirements	**[V2G-DC-146]**			7.7.1.3			
80	8.6.2.2	Applicable RFCs, limitations and protocol parameter settings	**[V2G-DC-148]**			7.7.2.2			
81	8.7.2	Supported ports	**[V2G-DC-149]**			7.8.2			
82	8.7.2	Supported ports	**[V2G-DC-151]**			7.8.2			
83	8.7.2	Supported ports	**[V2G-DC-153]**			7.8.2			
84	8.7.2	Supported ports	**[V2G-DC-154]**			7.8.2			
85	8.7.2	Supported ports	**[V2G-DC-155]**			7.8.2			
86	8.7.2	Supported ports	**[V2G-DC-156]**			7.8.2			
87	8.7.2	Supported ports	**[V2G-DC-157]**			7.8.2			
88	8.7.2	Supported ports	**[V2G-DC-158]**			7.8.2			
89	8.7.2	Supported ports	**[V2G-DC-159]**			7.8.2			
90	8.7.2	Supported ports	**[V2G-DC-160]**			7.8.2			
91	8.7.3.1	Structure	**[V2G-DC-161]**			7.8.3.1			
92	8.7.3.1	Structure	**[V2G-DC-162]**			7.8.3.1			
93	8.7.3.1	Structure	**[V2G-DC-163]**			7.8.3.1			
94	8.7.3.1	Structure	**[V2G-DC-164]**			7.8.3.1			
95	8.7.3.1	Structure	**[V2G-DC-165]**			7.8.3.1			
96	8.7.3.1	Structure	**[V2G-DC-166]**			7.8.3.1			
97	8.7.3.2	Header Processing	**[V2G-DC-167]**			7.8.3.2			
98	8.7.3.2	Header Processing	**[V2G-DC-168]**			7.8.3.2			
99	8.7.3.2	Header Processing	**[V2G-DC-169]**			7.8.3.2			
100	8.7.3.2	Header Processing	**[V2G-DC-170]**			7.8.3.2			
101	8.7.3.2	Header Processing	**[V2G-DC-171]**			7.8.3.2			

	DIN Sections	Description	Rqmt	SAE J2847/2		SAE J2931/1		SAE J2931/4	
102	8.7.3.2	Header Processing	**[V2G-DC-172]**			7.8.3.2			
103	8.7.3.2	Header Processing	**[V2G-DC-173]**			7.8.3.2			
104	8.7.3.2	Header Processing	**[V2G-DC-174]**			7.8.3.2			
105	8.8.1.3	EXI Settings for DIN SPEC 70121 Application Messages	**[V2G-DC-175]**			7.9.1.3			
106	8.8.1.3	EXI Settings for DIN SPEC 70121 Application Messages	**[V2G-DC-176]**			7.9.1.3			
107	8.8.1.3	EXI Settings for DIN SPEC 70121 Application Messages	**[V2G-DC-177]**			7.9.1.3			
108	8.8.1.3	EXI Settings for DIN SPEC 70121 Application Messages	**[V2G-DC-178]**			7.9.1.3			
109	8.8.1.3	EXI Settings for DIN SPEC 70121 Application Messages	**[V2G-DC-179]**			7.9.1.3			
110	8.9.3.1	General Information	**[V2G-DC-180]**			7.7.3.1			
111	8.9.3.3.1	Structure	**[V2G-DC-181]**			7.7.3.3.1			
112	8.9.3.3.1	Structure	**[V2G-DC-182]**			7.7.3.3.1			
113	8.9.3.3.1	Structure	**[V2G-DC-183]**			7.7.3.3.1			
114	8.9.3.3.1	Structure	**[V2G-DC-184]**			7.7.3.3.1			
115	8.9.3.3.1	Structure	**[V2G-DC-185]**			7.7.3.3.1			
116	8.9.3.3.1	Structure	**[V2G-DC-186]**			7.7.3.3.1			
117	8.9.3.3.2	Header Processing	**[V2G-DC-187]**			7.7.3.3.2			
118	8.9.3.3.2	Header Processing	**[V2G-DC-188]**			7.7.3.3.2			
119	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-189]**			7.7.3.4			
120	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-190]**			7.7.3.4			
121	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-191]**			7.7.3.4			
122	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-192]**			7.7.3.4			
123	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-193]**			7.7.3.4			
124	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-194]**			7.7.3.4			
125	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-195]**			7.7.3.4			
126	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-196]**			7.7.3.4			
127	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-197]**			7.7.3.4			
128	8.9.3.4	SECC Discovery Request Message	**[V2G-DC-198]**			7.7.3.4			
129	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-199]**			7.7.3.5			
130	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-200]**			7.7.3.5			
131	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-201]**			7.7.3.5			
132	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-202]**			7.7.3.5			

	DIN Sections	Description	Rqmt	SAE J2847/2		SAE J2931/1		SAE J2931/4	
133	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-204]**			7.7.3.5			
134	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-205]**			7.7.3.5			
135	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-206]**			7.7.3.5			
136	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-207]**			7.7.3.5			
137	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-208]**			7.7.3.5			
138	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-209]**			7.7.3.5			
139	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-210]**			7.7.3.5			
140	8.9.3.5	SECC Discovery Response Message	**[V2G-DC-211]**			7.7.3.5			
141	8.9.3.6	Timing and Error Handling	**[V2G-DC-212]**			7.7.3.6			
142	8.9.3.6	Timing and Error Handling	**[V2G-DC-213]**			7.7.3.6			
143	8.9.3.6	Timing and Error Handling	**[V2G-DC-214]**			7.7.3.6			
144	8.9.3.6	Timing and Error Handling	**[V2G-DC-215]**			7.7.3.6			
145	8.9.3.6	Timing and Error Handling	**[V2G-DC-216]**			7.7.3.6			
146	8.9.3.7	SECC Discovery service primitives	**[V2G-DC-217]**			7.7.3.7			
147	8.9.3.7	SECC Discovery service primitives	**[V2G-DC-218]**			7.7.3.7			
148	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-219]**	6.2.1	Handshake Request-Response Message Pair				
149	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-220]**	6.2.1	Handshake Request-Response Message Pair				
150	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-221]**	6.2.1	Handshake Request-Response Message Pair				
151	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-222]**	6.2.1	Handshake Request-Response Message Pair				
152	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-223]**	6.2.1	Handshake Request-Response Message Pair				
153	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-224]**	6.2.1	Handshake Request-Response Message Pair				
154	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-225]**	6.2.1	Handshake Request-Response Message Pair				
155	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-226]**	6.2.1	Handshake Request-Response Message Pair				
156	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-227]**	6.2.1	Handshake Request-Response Message Pair				
157	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-228]**	6.2.1	Handshake Request-Response Message Pair				
158	9.2.1	Handshake Request-Response Message Pair	**[V2G-DC-229]**	6.2.1	Handshake Request-Response Message Pair				
159	9.2.2	Message definition supportedAppProtocolReq and supportedAppProtocolRes	**[V2G-DC-230]**	6.2.2	Message definition supportedAppProtocolReq and supportedAppProtocolRes				

	DIN Sections	Description	Rqmt	SAE J2847/2		SAE J2931/1		SAE J2931/4	
160	9.2.2	Message definition supportedAppProtocolReq and supportedAppProtocolRes	**[V2G-DC-231]**	6.2.2	Message definition supportedAppProtocolReq and supportedAppProtocolRes				
161	9.2.2.1	Semantics description supportedAppProtocol messages	**[V2G-DC-233]**	6.2.2.1	Semantics description supportedAppProtocol messages				
162	9.3.2	Message definition	**[V2G-DC-234]**	6.3.2	Message definition				
163	9.3.2	Message definition	**[V2G-DC-235]**	6.3.2	Message definition				
164	9.3.3	Message Header Definition	**[V2G-DC-236]**	6.3.3	Message Header Definition				
165	9.3.4	Message Body Definition	**[V2G-DC-237]**	6.3.4	Message Body Definition				
166	9.4.1.2.1	Session Setup Handling	**[V2G-DC-238]**	6.4.1.2.1	Session Setup Handling				
167	9.4.1.2.1	Session Setup Handling	**[V2G-DC-239]**	6.4.1.2.1	Session Setup Handling				
168	9.4.1.2.1	Session Setup Handling	**[V2G-DC-241]**	6.4.1.2.1	Session Setup Handling				
169	9.4.1.2.2	Session Setup Request	**[V2G-DC-243]**	6.4.1.2.2	Session Setup Request				
170	9.4.1.2.2	Session Setup Request	**[V2G-DC-244]**	6.4.1.2.2	Session Setup Request				
171	9.4.1.2.3	Session Setup Response	**[V2G-DC-245]**	6.4.1.2.3	Session Setup Response				
172	9.4.1.2.3	Session Setup Response	**[V2G-DC-246]**	6.4.1.2.3	Session Setup Response				
173	9.4.1.2.3	Session Setup Response	**[V2G-DC-247]**	4.2.40 6.4.1.2.3	EVSE ID Session Setup Response				
174	9.4.1.3.2	Service Discovery Request	**[V2G-DC-248]**	6.4.1.3.2	Service Discovery Request				
175	9.4.1.3.2	Service Discovery Request	**[V2G-DC-249]**	6.4.1.3.2	Service Discovery Request				
176	9.4.1.3.3	Service Discovery Response	**[V2G-DC-250]**	6.4.1.3.3	Service Discovery Response				
177	9.4.1.3.3	Service Discovery Response	**[V2G-DC-251]**	6.4.1.3.3	Service Discovery Response				
178	9.4.1.4.1	Service and Payment Selection Handling	**[V2G-DC-252]**	6.4.1.4.1	Service and Payment Selection Handling				
179	9.4.1.4.2	Service and Payment Selection Request	**[V2G-DC-253]**	4.2.95 6.4.1.4.2	Service Payment Selection Req Service and Payment Selection Request				
180	9.4.1.4.2	Service and Payment Selection Request	**[V2G-DC-254]**	6.4.1.4.2	Service and Payment Selection Request				
181	9.4.1.4.3	Service and Payment Selection Response	**[V2G-DC-255]**	6.4.1.4.3	Service and Payment Selection Response				
182	9.4.1.6.2	Charge Parameter Discovery Request	**[V2G-DC-256]**	6.4.1.6.2	Charge Parameter Discovery Request				
183	9.4.1.6.2	Charge Parameter Discovery Request	**[V2G-DC-258]**	6.4.1.6.2	Charge Parameter Discovery Request				
184	9.4.1.6.2	Charge Parameter Discovery Request	**[V2G-DC-259]**	6.4.1.6.2	Charge Parameter Discovery Request				

	DIN Sections	Description	Rqmt	SAE J2847/2		SAE J2931/1		SAE J2931/4	
185	9.4.1.6.3	Charge Parameter Discovery Response	**[V2G-DC-260]**	6.4.1.6.3	Charge Parameter Discovery Response				
186	9.4.1.6.3	Charge Parameter Discovery Response	**[V2G-DC-262]**	6.4.1.6.3	Charge Parameter Discovery Response				
187	9.4.1.7.2	Power Delivery Request	**[V2G-DC-263]**	6.4.1.7.2	Power Delivery Request				
188	9.4.1.7.2	Power Delivery Request	**[V2G-DC-264]**	6.4.1.7.2	Power Delivery Request				
189	9.4.1.7.3	Power Delivery Response	**[V2G-DC-265]**	6.4.1.7.3	Power Delivery Response				
190	9.4.1.7.3	Power Delivery Response	**[V2G-DC-266]**	4.2.6 6.4.1.7.3	Charging Profile (ChargingProfile) Power Delivery Response				
191	9.4.1.7.3	Power Delivery Response	**[V2G-DC-267]**	4.2.6 6.4.1.7.3	Charging Profile (ChargingProfile) Power Delivery Response				
192	9.4.1.7.3	Power Delivery Response	**[V2G-DC-268]**	6.4.1.7.3	Power Delivery Response				
193	9.4.2.2.1	Cable Check Handling	**[V2G-DC-269]**	6.4.2.2.1	Cable Check Handling				
194	9.4.2.2.2	Cable Check Request	**[V2G-DC-270]**	6.4.2.2.2	Cable Check Request				
195	9.4.2.2.2	Cable Check Request	**[V2G-DC-271]**	6.4.2.2.2	Cable Check Request				
196	9.4.2.2.3	Cable Check Response	**[V2G-DC-272]**	6.4.2.2.3	Cable Check Response				
197	9.4.2.2.3	Cable Check Response	**[V2G-DC-274]**	6.4.2.2.3	Cable Check Response				
198	9.4.2.3.2	Pre Charge Request	**[V2G-DC-275]**	6.4.2.3.2	Pre Charge Request				
199	9.4.2.3.2	Pre Charge Request	**[V2G-DC-276]**	6.4.2.3.2	Pre Charge Request				
200	9.4.2.3.3	Pre Charge Response	**[V2G-DC-277]**	6.4.2.3.3	Pre Charge Response				
201	9.4.2.3.3	Pre Charge Response	**[V2G-DC-278]**	6.4.2.3.3	Pre Charge Response				
202	9.4.2.4.2	Current Demand Request	**[V2G-DC-279]**	6.4.2.4.2	Current Demand Request				
203	9.4.2.4.2	Current Demand Request	**[V2G-DC-280]**	6.4.2.4.2	Current Demand Request				
204	9.4.2.4.3	Current Demand Response	**[V2G-DC-281]**	6.4.2.4.3	Current Demand Response				
205	9.4.2.4.3	Current Demand Response	**[V2G-DC-282]**	6.4.2.4.3	Current Demand Response				
206	9.4.2.5.2	Welding Detection Request	**[V2G-DC-283]**	6.4.2.5.2	Welding Detection Request				
207	9.4.2.5.2	Welding Detection Request	**[V2G-DC-284]**	6.4.2.5.2	Welding Detection Request				
208	9.4.2.5.3	Welding Detection Response	**[V2G-DC-285]**	6.4.2.5.3	Welding Detection Response				
209	9.4.2.5.3	Welding Detection Response	**[V2G-DC-286]**	6.4.2.5.3	Welding Detection Response				
210	9.4.1.8.2	Session Stop Request	**[V2G-DC-287]**	6.4.1.8.2	Session Stop Request				
211	9.4.1.8.3	Session Stop Response	**[V2G-DC-288]**	6.4.1.8.3	Session Stop Response				
212	9.4.1.8.3	Session Stop Response	**[V2G-DC-289]**	6.4.1.8.3	Session Stop Response				
213	9.5.2.1	ServiceTagType	**[V2G-DC-290]**	4.2.99	Service Tag Type				