January 12, 2024

California Air Resources Board
Sustainable Communities and Transportation Division
1001 I St.
Sacramento, CA 95814

Submitted via Comment Log

Re: Advanced Clean Cars II Amendments Kickoff Workshop

Sustainable Communities and Transportation Division Staff:

EVgo appreciates the opportunity to provide comments on the California Air Resources Board's (CARB) Advanced Clean Cars (ACC) II Amendments Kickoff Workshop held on November 15, 2023. As one of the nation's largest public fast charging providers, EVgo recognizes that a convenient, seamless electric vehicle (EV) charging experience is crucial for mass scale EV adoption needed to help achieve California's energy, decarbonization, and air quality goals.[1] We commend CARB for initiating this rulemaking process to amend ACC II regulations in a manner that promotes interoperability between electric vehicle supply equipment (EVSE) and EVs.

An elevated charging experience is mission critical for EVgo. The company has taken proactive steps to ensure an enhanced customer experience, including but not limited to, continued progress on EVgo ReNew™[2], the release of several best practice guides[3] to promote codes and standards changes that will drive charger reliability and vehicle interoperability, and ongoing participation in forums such as the national labs' ChargeX consortium[4] and CharIN[5] to address root causes of charging experience issues across the EV charging ecosystem. Based on these efforts, EVgo urges CARB to continue coordinating with other stakeholders including automakers, charge point operators (CPOs), EVSE manufacturers and suppliers, and other government agencies.

To further enhance the EV charging experience for all drivers and ensure robust EV market growth, EVgo makes the following recommendations with respect to future ZEV Assurance Measures in ACC II:

1. Collaborate closely with the California Energy Commission (CEC) on proposed interoperability standards to enable a more seamless, convenient charging experience;

[1] EVgo has over 950 fast charging locations across more than 35 states, including stations built through EVgo eXtendTM, its white label service offering.
[2] https://www.evgo.com/blog/charging-into-the-future-of-range-confidence-with-evgo-renew/
[3] https://www.evgo.com/connect-the-watts/
[4] https://inl.gov/chargex/
[5] https://www.charin.global/

2. Require compliance with key communication standards that enhance vehicle interoperability (ISO 15118-2 and DIN 70121), but avoid adopting session timeout limits within these standards;
3. Require that EVs provide drivers with the ability to install their own certificates to enable Plug & Charge (PnC) via ISO 15118-2 to improve interoperability and promote customer choice;
4. Require Underwriter Laboratories (UL) 2252 certification for adapters supplied pursuant to ACC II regulations to enhance the EV charging experience and promote interoperability;
5. Consider requiring the seamless retry mechanism developed by the ChargeX Consortium to improve charging success rates; and
6. Seek further input on conformance testing for interoperability standards to enhance compliance with ACC II regulations.

1. Collaborate closely with the CEC on proposed interoperability standards to enable a more seamless, convenient charging experience

Close collaboration with the CEC is essential for incorporation of interoperability standards in ACC II. Standards alignment and prioritization between CARB and CEC is crucial because technical requirements for EVSE and EVs must be harmonized to enable a more seamless, convenient charging experience. EVgo recommends that CARB closely monitor the SAE Industry Trade Consortia (SAE ITC) EVPKI Consortium's process for developing and supporting a Certificate Trust List to ensure interoperability between root certificate authorities that enable Plug & Charge (PnC).[6] It is vital that industry reach consensus on issues raised in this consortium to support seamless, widely available PnC given that interoperability fails if only vehicles or charging equipment is required to implement ISO 15118 in isolation.[7]

In addition, CARB-CEC collaboration is necessary to resolve other issues at the EV-EVSE nexus. EVgo recently published a best practice guide to improve vehicle interoperability that extends beyond PnC and addresses other root cause issues that are necessary to facilitate a more convenient, reliable experience for all EV drivers.[8]

2. Require compliance with key communication standards that enhance vehicle interoperability (ISO 15118-2 and DIN 70121), but avoid adopting session timeout limits within these standards

EVgo supports requirements for EVs that improve communication between the vehicle and EVSE through well-established standards, including compliance with ISO 15118-2 and DIN 70121.[9] Supporting these standards will help to promote interoperability with all generations of fast chargers. However, EVgo encourages CARB to avoid requiring adherence to the sections of these standards that stipulate charging session timeouts for contract authentication and authorization. Currently, these standards call for a 60-second session timeout after a driver has plugged in their vehicle; if a driver takes longer to initiate a charge, the charging session will fail. After plugging in their vehicle, many customers could take

[6] https://www.sae-itc.com/programs/evpki
[7] ISO 15118 is an internationally recognized standard that specifies the communication between EVs and EVSE and enables a range of use cases, including PnC.
[8] https://site-assets.evgo.com/f/78437/x/e2ecd6d60d/evgo-vehicle-oem-best-practices.pdf
[9] https://site-assets.evgo.com/f/78437/x/e2ecd6d60d/evgo-vehicle-oem-best-practices.pdf

more than a minute to authenticate for a variety of reasons, including but not limited to searching for the appropriate payment card or experiencing distractions at the site. Session timeouts are a significant, yet avoidable, source of charging session failures that hamper a seamless, convenient charging experience.

EVgo supports longer session timeout periods (i.e., 150 seconds) that allow drivers ample time to initiate a charge once they have plugged in their vehicles. This extended timeout will help to improve first-time plug-in success rates for customers. Ultimately, these codes and standards should be amended to allow a more realistic time frame for customers to begin a charge.

3. **Require that EVs provide drivers with the ability to install their own certificates to enable Plug & Charge (PnC) via ISO 15118-2 to improve interoperability and promote customer choice**

There is currently no industry consensus on how EVs should permit the installation of certificates used to enable PnC via ISO 15118-2. To ensure that drivers retain the flexibility to easily enable PnC with their preferred CPO(s), EVgo recommends that CARB ensure that ACC II regulations promote drivers' ability to install their own certificates on their vehicles to enable PnC either via the EVSE or via the EV. In other words, EVgo recommends vehicles provide drivers with the option to easily switch out certificates when seeking to use PnC on different charging networks. Providing drivers with choice on vehicle certificates via ISO 15118-2 allows drivers to use PnC on charging networks that provide the most value to them and further enhances the EV charging experience.

4. **Require adapter safety certification (UL 2252) for adapters supplied pursuant to ACC II regulations to enhance the EV charging experience and promote interoperability**

Current ACC II regulations specify that any model year 2026 and newer EVs that do not come equipped with a native CCS port must be supplied with an adapter that enables the vehicle to fast charge with a CCS connector.[10] The regulation also states that these adapters must be tested and approved by a Nationally Recognized Testing Laboratory.[11] As noted in the CEC's September 2023 Statement on the North American Charging Standard (NACS), UL has initiated a process to establish safety standards for adapters under Underwriter Laboratories (UL) 2252 and ChargeX is also continuing to evaluate adapter safety.[12] EVgo encourages CARB to closely monitor UL's standards development process for adapters and consider strengthening its existing adapter regulations in ACC II to require that all adapters provided by automakers receive UL 2252 certification.

5. **Consider requiring the seamless retry mechanism developed by the ChargeX Consortium to improve charging success rates**

EVgo supports the incorporation of a seamless retry mechanism to improve vehicle-charger interoperability.[13] In the case of non-emergency failures, EVgo EVSEs will perform a "seamless retry" by

[10] https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/2acciifro1962.3.pdf
[11] *Id.*
[12] https://efiling.energy.ca.gov/GetDocument.aspx?tn=252421&DocumentContentId=87420
[13] https://site-assets.evgo.com/f/78437/x/e2ecd6d60d/evgo-vehicle-oem-best-practices.pdf

changing to state E, then to state B1, and finally to state B2. The vehicle must reinitiate signal level attenuation characterization (SLAC) to restart the charge without the need for a cable re-plug. This helps to improve the likelihood that a successful charge will be initiated on the first try. ChargeX is developing guidance on a seamless retry mechanism and EVgo recommends monitoring the results of the ChargeX process before considering adopting such a requirement in ACC II regulations.

6. Seek further input on conformance testing for interoperability standards to enhance compliance with ACC II regulations

The conformance tests CARB may consider will ultimately depend on the interoperability standards adopted in this rulemaking. As noted by EVgo and other stakeholders in CEC docket 22-EVI-06, CharIN is currently developing a conformance test for ISO 15118-2 that should be capable of evaluating both EV and EVSE conformance to the standard (CharIN CCS Extended).[14] EVgo remains optimistic about the development of CharIN CCS Extended as a conformance test; however, CharIN CCS Extended has not yet been finalized. EVgo recommends that CARB review CCS Extended once it is complete and allow the industry to carefully evaluate the conformance test and availability of conformance certification labs to ensure that this improves interoperability before considering it as a requirement. EVgo looks forward to continued coordination with CARB and other stakeholders on conformance testing.

7. Conclusion

EVgo appreciates the opportunity to comment on vehicle interoperability topics. A seamless, convenient charging experience requires coordination between CPOs, automakers, EVSE hardware manufacturers, and other stakeholders. CARB has an opportunity to further enhance the EV charging experience for all drivers through prudent adoption of interoperability requirements in ACC II, and EVgo looks forward to engaging further in this rulemaking process.

Respectfully submitted on this 12th day of January,

Noah Garcia
Manager, Market Development and Public Policy
EVgo Services, LLC
11835 W. Olympic Blvd., Suite 900E
Los Angeles, CA 90064
Tel: 310.954.2900
E-mail: noah.garcia@evgo.com

[14] https://efiling.energy.ca.gov/GetDocument.aspx?tn=253738&DocumentContentId=88992

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Best Practices for Vehicle Manufacturers - Interoperability

OEM, SPEC

Revision: A00

Table of Contents

Revision History

Rev #	Revision Description	Updated by	Approved by	Date
A00	Initial Revision	Jeremy Bibeau	Keith Beckstead	8/15/2023

1. Introduction

1.1. Purpose/Objective:

The purpose of this document is to define a set of hardware and software best practices for electric vehicles to ensure seamless interoperability between electric vehicles (EV) and electric vehicle supply equipment (EVSE), specifically on the EVgo network. Many of the requirements listed in this document are either not included in any widely recognized standards or left for interpretation. Some requirements highlight existing standards requirements that are often not properly implemented. The requirements laid out help to improve either the safety or convenience of the charging experience.

1.2. Scope:

The requirements in this document apply to all battery electric vehicles (BEV) that are capable of DC fast charging via a CCS1 connector.

1.3. Documentation:

ISO 15118-2:2014	Road vehicles - Vehicle-to-Grid Communication Interface - Part 2: Network and application protocol requirements
ISO 15118-20:2022	Road vehicles - Vehicle to Grid Communication Interface - Part 20: 2nd generation network layer and application layer requirements
DIN 70121:2012	Electromobility - Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging in the Combined Charging
SAE J1772:2017	SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler
IEC 61851-23:2014	Electric vehicle conductive charging system - Part 23: DC electric vehicle charging station

1.4. Definitions:

BEV	Battery Electric Vehicle
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
SLAC	Signal Level Attenuation Characterization

2. Best Practices

2.1. Accepted Protocols

Vehicles shall be capable of communicating using the DIN 70121 and ISO 15118-2 protocols.

Supporting these protocols will help to promote interoperability with all generations of DC fast chargers. In the future, it will also be recommended that all vehicles are capable of using ISO 15118-20.

2.2. SLAC Timing

Vehicles shall send CM_SLAC_PARM.REQ as quickly as possible after a state change to B2, waiting no longer than 3 seconds.

Although the requirement for beginning SLAC is a maximum of 10 seconds, it is ideal to have this initiate as quickly as possible. This helps to reduce the overall time that customers wait before charging begins. Additionally, SLAC shall initiate no sooner than 200ms to avoid communication problems.

2.3. Authentication Timeout

For both DIN 70121 and ISO 15118, vehicles shall wait at least 150 seconds in contract authentication/authorization before triggering a timeout.

Authentication timeout is one of the most frequently observed errors on the EVgo network. Relevant standards specify timeouts as short as 60 seconds for contract authentication. After plugging in their vehicle, many customers take more than a minute to authenticate for a variety of reasons (app download, searching for credit card/RFID card, etc.). Extending this timeout will help to improve first plug-in success rates for customers.

2.4. Cable Check Timeout

For both DIN 70121 and ISO 15118, vehicles shall wait at least 60 seconds in cable check before triggering a timeout.

For EVSEs that power share, additional time is required to reallocate power modules between dispensers. As a result, a timeout level of 60 seconds will provide adequate time for this process to complete.

2.5. Inclusion of Maximum Power Limit

Vehicles shall include the maximum power rating of the vehicle in charge parameter discovery and current demand.

In DIN 70121 (Table 71) and ISO 15118-2 (Table 101), maximum power limit is considered an optional parameter. However, this parameter can be useful for the EVSE to provide accurate power allocation. The parameter is mandatory in ISO 15118-20.

2.6. Charge Parameter Discovery Matches Current Demand

The maximum voltage, current, and power limits provided in charge parameter discovery shall match the values provided in current demand.

Similar to §2.4, these values are used for power sharing and can negatively impact charger behavior if they are not consistent.

2.7. Respect EVSEIsolationStatus

In the event of a "Fault" isolation status, the vehicle shall perform a normal shutdown, if not already initiated by the EVSE.

Although the EVSE is designed to initiate a normal shutdown in the case of an isolation fault, the vehicle should also detect this status and perform a shutdown in the case that an EVSE does not properly shutdown.

2.8. Respect EVSEStatusCode

In the event of an EVSE_Shutdown or EVSE_EmergencyShutdown status code, the vehicle shall stop sending current demand requests and send a power delivery request.

It is important that the vehicle halt any further current demand requests once a shutdown is requested by the EVSE, whether it be a normal shutdown or an emergency shutdown.

2.9. Target Voltage

The target voltage given in Current Demand shall be 20 to 30 volts higher than the actual battery voltage.

By giving a buffer of 20 to 30 volts, the EV ensures that the EVSE will not enter voltage mode.

2.10. Current Demand Slew Rate

Once current demand begins, the vehicle's current requests shall increase by at least 10A per second until desired current is reached.

To improve customer experience, it is important to reach full load in a reasonable amount of time (for the appropriate point of the charge curve). EVgo chargers are designed to be able to react quickly to changes in current demand levels.

2.11. Seamless Retry

Vehicles shall initiate SLAC based on the following state change sequence: Any State → E → B1 → B2. The vehicle shall be capable of following this sequence at least five times without unplugging the cable.

In the case of non-emergency failures, EVgo EVSEs will perform a "seamless retry" by changing to state E, then to state B1, and finally to state B2. The vehicle must reinitiate SLAC in order to restart the charge without the need for a cable re-plug. This helps to ensure first-plug success for the customer.

2.12. EVCCID and MAC Address

The EVCCID shall match the MAC Address of the EVCC.

Per DIN 70121 and ISO 15118, the EVCCID shall contain the MAC address of the EVCC. On the EVgo network, this is important for the proper function of Autocharge.

2.13. Inlet Locking

The vehicle shall wait to lock the inlet until after Charge Parameter Discovery is finished.

Per J1772 F.1.1, it is recommended that the vehicle wait until after charge parameters have been exchanged to lock the inlet.

2.14. Inlet Unlocking

The vehicle shall unlock the inlet when the current is near zero, voltage at the inlet is below 60VDC, and the EVSE performs a state change to B1.

As long as the current is near zero, voltage is below 60VDC, and the EVSE has transitioned to state B1, the EV and EVSE will be in a safe state to unlock the inlet and allow the customer to remove the cable. Keeping the cable locked with these conditions can cause confusion. Vehicle manufacturers may opt to utilize a button next to the inlet as a final step to unlock the connector, provided the aforementioned conditions are met.

2.15. Stuck Cable Information

EVgo is requesting the following information on all vehicles in order to rectify issues involving a stuck connector.

1. Send instructions to follow on site when a CCS1 vehicle will not release the receptacle latch.
2. Does the vehicle use a linear actuator or receptacle locking mechanism?
3. Is there a mechanical pull cable that will allow for moving the linear actuator back? If so, please send instructions on how to access this.
4. Will a 12V disconnect and reconnect allow for the linear actuator to withdraw?
    a. Send instructions on how the 12V auxiliary battery can be disconnected (or related fuse).
    b. After reconnecting 12V, what is the amount of time before the linear actuator will withdraw?
5. Are there known conditions where the vehicle receptacle will keep the vehicle connector latched even though charge has completed?

2.16. AC Proximity Response

Vehicles shall terminate the charge during AC charging within 100ms of an S3 button press.

Per J1772 Table 14, the EV shall terminate the charge within 100ms of the proximity circuit opening (S3 button press). This helps to prevent arcing between the inlet and connector when the cable is removed during active charging. It is also recommended that the vehicle utilizes an inlet lock for AC charging. Since AC pins can break within less than 100ms from losing proximity and pilot, this will

help to avoid arcing. A button next to the charge port provides a convenient way for a customer to stop the charge and prompt the vehicle to release the lock. The 100ms requirement still applies to vehicles that lock the inlet during AC charging (in case of broken latch).

2.17. Onboard Boost Converter

Onboard boost converters for low voltage EVSEs will require up to 50kW.

On the EVgo network, the only EVSEs that stop at 500VDC have a maximum output of 50kW. Therefore, it is necessary for an onboard boost converter to be rated for up to 50kW.

2.18. Onboard Boost Control System

Control systems for onboard boost converters shall be fixed duty or feedforward.

In order to improve line regulation of the output voltage, control systems shall utilize fixed duty or feedforward circuitry.

2.19. DC Pin Protector Pull Force

The minimum pull force on the DC pin protectors in the charging inlet shall be 40 N.

Compliance to the 40N pull force requirement should be tested after the thermal cycling described in IEC 62196-1 ed 2022. A buildup of foreign objects in a connector can potentially cause damage to pins and forces an angle when inserted that can lead to arcing. The metal pin should include a chamfer just past the isolation cap to reduce the sharp edge, in the event the protective cap does come loose, to prevent abrasion to female pin in EVSE connector. See Figure 1 for a depiction of these protective covers.

Figure 1: DC Pin Protectors