

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460



OFFICE OF AIR AND RADIATION

September 4, 2018

Dear Electric Vehicle Supply Equipment (EVSE) Stakeholder:

The U.S. Environment Protection Agency (EPA) will host a second working session to engage with stakeholders on topics key to the development of the ENERGY STAR® Version 1.1 EVSE Test Method for DC-output EVSE. To facilitate a meaningful discussion of these topics, prior to this working session EPA is sharing a summary of each topic, potential approaches, as well as discussion questions.

Registration

WORKING SESSION #2: September 12 at 3 – 5 PM Eastern Time

Focus Areas: EPA would like to discuss outcomes from the first working session, scope, appropriate loading conditions for testing during a charging event, and accounting for features/functions such as cooling (e.g., of power conversion and cables) and battery banks.

Registration: If you would like to participate in the Working Session #2, [please register here](#).

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Discussion Topics for Working Session #2 on September 12, 2018

Outcomes from Working Session #1

During the first working session that EPA held on August 22nd, EPA discussed the following topics and through stakeholder discussions, will be proposing the following in a Draft 1 Test Method:

1. **Testing Cabinet/Dispenser Configurations:** Some EVSE have two separate enclosures – one houses the power conversion equipment (cabinet) and another that connects to the vehicle and houses the user interface (dispenser). EPA proposes testing the Cabinet and Dispenser components together, as one system, to ensure that the test method will allow for comparison between the efficiency measurements for this type of product configuration and a configuration that has all components inside one enclosure. Stakeholders agreed that this would be the best proposal for testing these types of products to ensure for fair comparison between the two configurations.
2. **Cable Losses:** EPA proposes testing Cabinet/Dispenser products with the shortest possible cable connecting the cabinet and dispenser components. Stakeholders noted that to allow for the fairest comparison between Cabinet/Dispenser and All-in-One products, EPA should test the Cabinet/Dispenser with the shortest cable.

- 3. Testing in Relevant Modes of Operation:** In the Discussion Guide that was released on May 24, EPA proposed a test procedure for two modes – No Vehicle Mode and Operation Mode – and believed that these were the most relevant modes for DC EVSE because EV drivers are often encouraged to disconnect vehicles from DC charging stations at the end of a charging session to allow for more turnover. However, stakeholders noted that there are applications where DC EVSE may be connected to a vehicle, but not actively charging for significant periods of time – including fleet-based applications, future residential applications, and when a battery storage system is present.

These stakeholders noted that additional testing will be relevant for the mode in which there is a vehicle present and connected to the EVSE but the EVSE is not providing current. As a result of this discussion with stakeholders, EPA is considering proposing a test procedure for this additional mode in the Draft 1 Test Method. In addition, one stakeholder commented against measuring Operation Mode; however, given the large savings potentially available in Operation Mode, EPA continues to propose testing in this mode.

Scope

In the Discussion Guide, EPA proposed including all DC EVSE that provide a maximum current greater than or equal to 80 A in the scope of the Version 1.1 specification. However, EPA has heard from stakeholders that there are DC EVSE that provide less than 80 A maximum current, and those products should be included in the scope of the specification.

Several stakeholders have noted that EPA should consider limiting the scope because certain technologies are new to the market and still being developed. They noted that these products may be inadvertently excluded from participating in the ENERGY STAR program because they are not properly accounted for at the time of the test method development, since they are still under development. They specifically stated that higher-power DC EVSE, custom-built products, and those intended for large commercial use cases (e.g., charging buses) should be excluded until they are more established in the market and an approach to fairly testing is clear. EPA would like to discuss the scope with stakeholders to determine what should be included in the Version 1.1 specification.

Appropriate Loading Conditions

In the Discussion Guide, EPA proposed a test procedure for Operation Mode, with the goal of testing at various loading conditions to demonstrate the efficiency at the maximum power output and also as the charge begins to ramp down when the vehicle is no longer accepting maximum current. EPA expects that testing at each loading condition will be brief (~5 minutes) so testing at 5 loading conditions would not be overly burdensome.

The test conditions EPA proposed in the Discussion Guide can be seen in the below table. The proposed output powers were based on levels that EPA has seen in the market or understands are under development (for higher power DC EVSE), while the voltages were based on popular EV battery pack voltages at full charge. For the maximum power, EPA had proposed a voltage that is calculated from the maximum power by dividing by 0.5 A and adding 300 V, to provide a voltage proportional to power, and results in 1300 V at 500 kW and 400 V at 50 kW. EPA proposed $\pm 2\%$ tolerance as in the current AC EVSE test procedure.

It is important to note that the loading conditions proposed in this table may be impacted by the outcome of the discussion of scope, specifically if specific maximum output powers are excluded.

	Test Conditions	Example for 500 kW capable UUT	Example for 350 kW capable UUT	Example for 150 kW capable UUT
Loading Condition 1	Max Available Power Output $\pm 2\%$ and Voltage = $P_{out} / 0.4 \text{ A} + 300 \text{ V} \pm 2\%$.	500 kW	350 kW	150 kW
Loading Condition 2	350 kW ± 7 kW and 900 V ± 18 V	350 kW	Tested above	Do not test
Loading Condition 3	150 kW ± 3 kW and 400 V ± 8 V	150 kW	150 kW	Tested above
Loading Condition 4	50 kW ± 1 kW and 350 V ± 7 V	50 kW	50 kW	50 kW
Loading Condition 5	30 kW ± 0.6 kW and 350 V ± 7 V	30 kW	30 kW	30 kW

Stakeholders submitted feedback in support of test conditions at voltages/currents representative of charging rates for existing vehicles. EPA would like to discuss the following with stakeholders in regards to these proposed test conditions:

1. Testers will need to use specialized test equipment that will be able to communicate with the EVSE and read its maximum current and perform required handshaking to perform testing at these conditions. EPA plans to reference SAE J1772 Appendix F regarding signaling for DC EVSE to specify the power for testing. Do stakeholders have suggestions regarding what equipment/controls will be needed to communicate these test conditions to the EVSE?
2. Should EPA consider any additional or different loading conditions than those specified in the table above to determine efficiency of the EVSE during Operation Mode charging?
3. EPA understands that there are a variety of DC EVSE power levels on the market today and planned for the future, including lower powered stations (50 kW) and higher powered stations (500 kW). Will these test conditions appropriately capture the efficiency during the charging profile of DC EVSE in the market today and those planned for the future?

Accounting for DC EVSE Features/Functions

In the Discussion Guide, EPA proposed testing DC EVSE at three different temperatures because efficiency can vary significantly based on ambient conditions. DC EVSE can have varying cooling/heating strategies to maintain the temperature of the system and the cables during charging or based on ambient temperature. EPA has learned that cooling systems for EVSE will typically turn on after the EVSE reaches a particular temperature (either due to the ambient temperature or internal heating from operating at high power). Three stakeholders recommended measuring total DC EVSE energy usage, including the energy used for heating/cooling.

As a result, EPA has the following questions to discuss with stakeholder in order to appropriately account for the efficiency of an EVSE in maintaining a temperature range during testing:

4. Are heating/cooling systems installed in all DC EVSE sizes (e.g., 50 kW stations and those with less power output)?
5. How should EPA best account for the power required to provide liquid cooling to the cables during testing?
6. EPA is interested in learning about differing cooling strategies that can be used to minimize the amount of cooling needed and increase the efficiency of the overall charge. EPA welcomes feedback on the typical operating characteristics of cooling systems and how to structure and sequence tests so they are representative. Specifically, concerning the order of the tests, their duration, and wait times between them.

Also, EPA has learned that some EVSE may contain battery banks for the purposes of backup power or reducing peak demand (kW). Three stakeholders recommended requiring testing these units without the battery installed (if sold in this configuration) **and** with the battery installed but disabled.

EPA would like stakeholder feedback on the following testing proposals to account for energy loss from the battery itself:

7. Should EPA account for the charge/discharge losses due to the battery, or try to exclude them by disconnecting the battery?
8. Alternatively, should EPA require that the battery be disabled for one test and enabled for a second test?
9. Finally, if including the battery, how should EPA ensure that the Operation Mode test exercises the battery in a representative fashion (sufficient discharge and recharge)?

All work on the test method and specification development effort will be posted to the [Version 1.1 EVSE specification development webpage](#). Please contact me at Kwon.James@epa.gov or (202) 564-8538, or Emmy Feldman at ICF at Emmy.Feldman@icf.com or (202) 862-1145, with any questions or concerns or to arrange a discussion regarding these topics or others related to this test method development. Stakeholder engagement is vital to the ENERGY STAR program, and EPA welcomes stakeholder suggestions regarding additional ways to enable participation in this process. EPA looks forward to Working Session #2 and further work with stakeholders to find a successful path forward for these issues key to including DC-output EVSE in the ENERGY STAR program.

Best Regards,

James Kwon
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