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Subject: ClipperCreek comments addressing ENERGY STAR EVSE program

Verena,

Thank you for this opportunity to work together and consider the E* proposed standard. In addition, my staff is making measurements of our various products for submission before December 17th.

General comments are included below:

Essentially, the E* standard proposes to create a set of criteria which will mostly serve to set a standard for power loss in extension cords. Perhaps this is not well understood by E* staff, but the EVSE is basically a GFCI extension cord for the EV with some optional extra safety functions and a very safe and durable SAE-J1772 connector. This is true if the unit is wall mounted or a cord set.

Fundamentally, in terms of power usage, the products are essentially one of these pictured below. This is because there is very little power used by the device vs. the IR losses in power transfer from the premise wiring to the vehicle. In fact, the situation is even more skewed if the power losses through the premise wiring was to be considered in the equation as they are quite significant.

This is especially true for cord sets and basic wall mounted units. Even in the case of "smart" connected units, the energy consumption of the device to perform mandatory functions is very small compared to the IR energy losses through the device and EV power cord.

Consider this basic, generalized scenario when charging:

1. 10W 32A, L2 wall box, residential 240V: 5W consumed + 5W internal IR losses
2. 50W 25' of 32Amp cable, IR losses
3. 500W internal EV battery charger, assume approximately 94% efficiency overall

In this typical scenario, the actual energy consumed is 5W, whereas the IR losses attributed to the transfer of energy from the wall to the vehicle are 55W, or 10 times. The vehicle energy loss is a whopping 100X the energy loss of the EVSE. EVSEs are not really consumers of energy, they are just a pass through devices for energy to the EV as a load. The primary energy losses are IR losses directly related to current. The losses in the EV cable can rise to over 100W in certain scenarios.

Given the much greater contribution of the IR losses in the cable, the length of the cable will be a huge factor in determining the loss of energy as per the specifications draft 2. The usability and cost of the product is directly affected by the length of the cable. My opinion is that it would be very undesirable for E* to essentially set standards for the output cable length since that by far dominates the energy "consumption" as per the Draft 2 Test Method.

It is our opinion that cord sets should be eliminated from the standard. They are typically delivered with the vehicle, are essentially an extension cord, and consume very little energy compared to the IR losses in the cable. They are only provided for emergency or infrequent use. The energy transfer is rate is very low, 1kW to 1.4kW, and as battery pack sizes increase over the coming decade, these cord sets will become less and less useful except for pure emergency use. A L1, 12Amp, 120V device may consume 3W of operation, 3W of internal IR loss, but still have 30W of cable loss when in use, with hundreds of watts of loss in the battery charger of the BEV.

With regards to the energy consumption of the EVSE when not in the charging mode, basic functionality is addressing safety risks, as it would be with a GFCI cord set shown above. There are several basic safety functions that must be continuously operational in order to meet UL standards and the NEC. It is not clear that it would be good practice to attempt to turn off these functions even when the cord set is not actively charging. Several of the critical functions including continuous assurance that the cord set is de-energized, and verification of the bonded grounding path. There are also various self-test functions that the cord set may have to perform regularly.

The market for "Smart Grid" EVSEs is in its very early stages. As a leader in utility connected charging stations, ClipperCreek is still developing many types of communicating stations and the industry as a whole has not worked out any kind of standard approach. The entire industry is still solidly in the R&D stage. However, in all of ClipperCreek's utility driven product pilots to date, it has been necessary for the communications portion of the EVSE to remain "awake" and responsive to smart grid control events and utility communications, even when not in the active charging mode. Regardless, these kinds of functions utilize modern communication equipment and do not add that much energy use to the product. Say in one generalized case perhaps 20W non-charging with communications vs. 10W without communications. However, compared to the losses in the cable, not very significant.

Devices that include more sophisticated user interfaces (i.e. touch screen) generally serve the purpose of revenue recovery. These devices often also require communication equipment in order to operate. The front panel needs to remain live at all times and available to interaction with the user. Devices also offer and opportunity for advertising revenue, not something to be turned off.

As discussed during the EVSE Draft 2 Test Method Webinar, there was the question as to what current level should be used to test the products. It should definitely not be the pilot signal, but rather the NRTL name plate maximum continuous current rating. Since the majority of loss of energy from the service to the vehicle is in the cable, and that is dominated by the current level, it would be important to control the current accurately and to the maximum rating on the name plate. It is important not to regulate cable length and penalize EVSEs with longer cable lengths solely on the IR losses. EVSEs are pass through devices that serve the same purpose as an extension cord. The length and construction of the cord to the vehicle will dominate the overall losses.

In summary, please consider that in practice, the energy losses of the system are well dominated by the EV battery charger during the many hours of charging, followed by the IR losses in the EV cord and the service conductors from the supply transformer, and then by IR loses in the EVSE, and then the very least is consumed in the EVSE function, many of which are safety related and should or could not be turned off.

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Specific comments to the Draft v2 are included below:

72 B)EVSE Functions:
73 1)Primary Function: Function providing the intended purpose. For EVSE, Primary Functions are:

A primary purpose of the EVSE is to address the risks of Electric Shock and Fire, and it must be NRTL listed to meet those requireme nts, and perform those functions at all times.

93 d)Communicating with the vehicle;
94 e)Illumination of display, indicator lights, or ambient lighting;
95 f)Public access control (RFID card, authorization, etc.);
96 g)Safety Functions;
97 h)Control Pilot Signal
98 i)Wake-up function.

These are safety functions and are required by UL standards to be functional at all times, they are actually higher priority than connecting power to the EV

116 a)Operation Mode or State C[3]: Condition during which the equipment is performing at least one
117 primary function.

Safety functions must be active in these modes

178 4.2.2 DC EVSE.

179 **Note:** As the energy impacts of AC EVSE are expected to be greater, EPA will consider DC fast and slow

180 chargers in future versions of the EVSE specification.

181 4.2.3 Wireless/Inductive EVSE.
182 4.2.4 Power electronic components inside the vehicle.

Why are these not included since they represent the largest waste of energy - all three waste or use 100 times the energy of an AC EVSE !

184 A) Test Setup and Instrumentation: Test setup shall be in accordance with the diagram in Figure 2, with
185 additional requirements specified below. All required industry safety tests should be performed prior
186 to the following test to ensure quality and safety.

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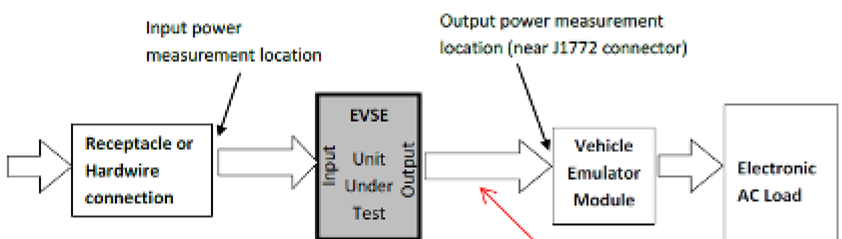

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189 **Figure 2: Schematic of test setup connection**

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All high current loads tested like this will primarily show cord loss only within the resolution of loads above 100W being +/- 1W. EVSE PWB will typically be less than 0.5% of total load.

Table 1: Input Supply Requirements

Voltage	Frequency
240 V AC	60 Hz
208 V AC	60 Hz
120 V AC	60 Hz

Table 2: Input Power Tolerances

Voltage Tolerance	Maximum Total Harmonic Distortion	Frequency Tolerance
+/- 4.0 %	5.0 %	+/- 1.0 %

since the power loss in the cable represents 10x the loss in the EVSE, and if the load is resistive, then 4% error in voltage may result in a variance greater than the loss in the EVSE as a result of variance in the current

a) 0.01 W for measurement values less than 10 W;
b) 0.1 W for measurement values from 10 W to 100 W; and
c) 1.0 W for measurement values greater than 100 W.
5) Accuracy: +/- 0.1% of reading PLUS +/- 0.1% of full scale
6) Measurements and Calculations:
a) Voltage (RMS);
b) Current (RMS);
c) Average Power (W); and

1.0W minimum resolution is not accurate enough to reliably test the losses that attributable to the EVSE PWB, less cord. These wattages can be typically less than 10W.

480 3) State C11: Plug in the UUT output connection to J1772 vehicle inlet on VEM. Connect S1 in the
481 VEM. Measure and record: 482 a) UUT input power; and
483 b) UUT output RMS voltage and output power (to verify zero output power).
484 E) Power shall be measured according to IEC 62301 Ed 2.0-2011; with the additional guidance in 485 Section 6 of this document.

Subtracting UUT output power from input power may be problematic, since the power loss is mostly in the IR losses in the cable.

501 3) Calculate the available current from the measured Control Pilot Duty Cycle per Table 3.

Products should be tested against the maximum current on the name plate

510 D) Warm-up
511 1) Engage the AC load and draw full current output for 30 minutes or more.
512 2) Only one warm-up period of 30 minutes is required for each unit under test at the beginning of the
513 test procedure.

What is the point of the warm-up period? An EVSE is basically an extension cord with mandatory safety functions and an internal contactor to keep the cable de-energized when not plugged in -- what will warming up do?

544 Table 4: Loading Conditions for UUT **Test Condition Current (A)**		**Example for 80 A capable UUT**	**Example for 32 A capable UUT**	**Example for 16 A capable UUT**
Loading Condition 1	Available Current (determined in Section 7.5.C), above) ± 2%.	80.0 A	32.0 A	16.0 A
Loading Condition 2	30.0 A ±0.6 A	30.0 A	30.0 A	Do not test
Loading Condition 3	15.0 A ±0.3 A	15.0 A	15.0 A	15.0 A

Loading for condition 3 could be defined as a percentage of maximum current, to make it more applicable to all units.