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Subject: ClipperCreek comments addressing ENERGY STAR EVSE program Draft 2 Specifications

Verena,

Thank you for this opportunity to work together and consider the E* proposed standard.

ClipperCreek appreciated the opportunity to attend and participate in the most recent webinar on 9/15/2016. During those discussions, E* staff put forth various requests for written submissions on various topics, which this document attempts to address.

It was also noted that there was insufficient time to review all topics in a thorough manner. ClipperCreek requests an additional webinar so that all industry participant's input can be reviewed before moving to the next step in the standards development cycle.

Please consider the following as included with the comments previously submitted on 11/17/2015 and on 3/30/2016 which contain, in ClipperCreek's expert opinion, facts relevant to the proposed standards.

1. ClipperCreek data provided with accuracies only to the nearest +/-1W and do not miss-direct the customer

Reference table Figure 1, data presented with no digits to the right of the decimal point for accuracy as provided to Energy Star. This is because given the test procedure parameters and equipment, ClipperCreek was not able to represent any accuracy better than the nearest +/-1W.

It should be noted, that ClipperCreek had submitted data on several products, some of which were constructed of identical circuit cards with identical energy consumption profiles. However, combining E* misinterpretation of the data's accuracy along with the acceptance criteria of 2.6W would result in some products meeting the standard and some not meeting the standard.

As pointed out in ClipperCreek's submitted comments from 3/30/2016, please do not restate the accuracy of the submitted data to the nearest 0.1W. At best, it was collected to the nearest +/-1W.

ClipperCreek would like to point out that EVSE market is still in the very early stages of development. These products have very long development cycles for EVSEs (2 years or more), and that Energy Star ratings can have a dramatic impact on an industry. Attempting to specify minimum ratings to the nearest 0.1W in a total charging system that can dissipate 100's of watts of waste energy when actively charging is to stringent.

Consider the initial standard to set a minimum power consumption to a 1W level. The industry's time and capital would be far better spent reducing the 100's of watts consumed on the vehicle rather that trifling with tenths of watts in the diminutive EVSE consumption.

It may be deceptive to the consumer, who will operate under the assumption that they are saving energy with an Energy Star marked EVSE over the unmarked EVSE, wherein the reality is just a few watts less a month are consumed between the two EVSE products. But in truth, each time their poorly constructed EV is charged, 100's of extra watts are consumed every single day!

Here is the data ClipperCreek provided:

Figure 1 ClipperCreek data presented to Energy Star – note that accuracy, as implied by standard engineering principals, is +/-1W

	ClipperCreek, Inc.	12/14/2015	JmF	v11	1	2	3	4					
	Unit	Measured Line Voltage	Measured Line Current	Level	S2 Open, Circuit Card Only No Load Watts	S2 Closed, Relay Power Only No Load Watts	S2 Closed, Circuit Card & Relay IR Losses Watts	S2 Closed, EV Cable IR Losses Watts	Total Watts	EV Power Conductor Gauge AWG	EV Power Cord Length Feet	Power Input Conductor Gauge AWG	Power Input Conductor Length Inches
1	2016 Volt - cord set	120	0.02	1	2				2	16	25	14	12
	No Load	120	0.03	1	2	2			4				
	Intermediate current, 6A	118	5.70	1	2	2	1	7	12				
	Max Current, 12A	116	11.20	1	2	2	3	27	34				
2	PCS-120 - cord set	120	0.03	1	3				3	14	22	16	12
	No Load	120	0.06	1	3	4			7				
	Intermediate current, 10A	118	9.46	1	3	4	1	11	19				
	Max Current, 12A	117	11.31	1	3	4	2	16	25				
3	HCS-40 - Wall Mounted Basic	210	0.01	2	3				3	10	25	N/A	N/A
	No Load	207	0.03	2	3	4			7				
	Intermediate current, 16A	207	16.70	2	3	4	10	16	33				
	Max Current, 32A	206	29.80	2	3	4	19	52	78				
4	CS-40SG2 Smart Grid - Networked	206	0.07	2	15				15	10	25	N/A	N/A
	No Load	206	0.11	2	15	7			22				
	Intermediate current, 16A	207	16.70	2	15	7	4	16	42				
	Max Current, 32A	205	29.70	2	15	7	9	53	83				
5	HCS-60 - Wall Mounted Basic	209	0.01	2	3				3	8	25	N/A	N/A
	No Load	204	0.03	2	3	4			7				
	Intermediate current, 16A	208	16.80	2	3	4	4	10	21				
	Max Current, 48A	204	48.08	2	3	4	23	83	113				
6	CS-100 - Wall Mounted Basic	205	0.02	2	3				3	6	25	N/A	N/A
	No Load	205	0.14	2	3	26			29				
	Intermediate current, 32A	202	29.80	2	3	26	6	21	56				
	Max Current, 100A	205	83.10	2	3	26	25	163	217				

2. Eliminate Idle Mode requirements because the EVSE is not a primary consumer of energy, but rather serves as an extension cord to connect an EV to the electrical service.

Energy Star is focused on the energy loss of the least relevant area in the EV charging system as a whole. The EVSE is not a significant consumer of energy in order to perform the primary function of EV charging.

Level 1 and 2 EVSEs are essentially extension cords. They are not consumers of relevant amounts of energy but rather simply serve the purpose of connecting the vehicle to the electrical service, like an extension cord that extends the power from a wall plug to an electrical appliance such as a refrigerator, which is the actual consumer of energy. For the EVSE to electric vehicle systems the consumer of electricity is the onboard battery charger and the electric vehicle sub-systems. The EVSE is merely an extension cord and safety device intended to allow the consumer to safely utilize the 240V electrical service as per the NEC section 625 has defined it for over 20 years.

Consider this basic, generalized scenario for the entire charging system:

1. 5W Partial On Mode with critical safety functions active
2. 15W 32A, L2 wall box, residential 240V: 10W consumed for Operation Mode + 5W internal IR losses
3. 50W 25' of 32Amp cable, IR losses
4. 100W power loss in the premise wiring
5. 500W internal EV battery charger, assume approximately 94% efficiency overall

Consider a soon to be common place 200 mile BEV scenario. Over the course of an 8 hour charge, the 5W of losses in the EVSE are not relevant in the system as a whole. Certainly it leaves little energy reduction gains to be had, just 2.5W if cut in half at some high component cost to the EVSE manufacturers and consumers. Considering that during an 8 hour charge the CONSUMER of the electricity would use 61kW of energy, with inefficiencies on the order of 3kW. The 2.5W of standby power gains in the EVSE for the remaining 16 hours of the day would be insignificant. Energy Star should present justification for these gains with a consumer cost benefit model.

The efforts of the Energy Star team to develop, implement, validate, and market a new standard should be invested in an area that could have a significant effect, the EVSE is a poor choice.

Commercial costs to develop and safety certify new EVSEs are significant and can take two years or more. Unlike consumer electronics devices whose designs are updated frequently, the safety regulations (UL2594) and tough environmental operating conditions (outside in the weather) are expensive and time consuming to meet for EVSEs. Evidence needs to be presented that costs passed on to the consumer associated with implementation of power loss reduction for reducing EVSE Idle Mode or Partial Power Mode are sufficient to justify the power level target presented. An argument was presented for the IR energy loss in the cable but nothing was presented for the Base criteria of 2.6W.

3. The EVSE is a slave to the EV when connected therefore Idle Mode is not feasible, eliminate Idle Mode

When the EVSE is plugged into the vehicle, it is a slave to the vehicle. It is required to turn on the contactor and connect the vehicle to the service mains whenever the vehicle asks. Therefore, it is not possible for the EVSE to power down once charging is complete. In fact, the EVSE has no knowledge of the EV's charging state. The EVSE cannot tell what the EV is doing, the state of charge, or even if the EV is using full power or no power.

The EVSE's purpose is to monitor for safety conditions such as service ground and CCID (GFCI) faults and to turn on the contactor upon EV requests. The EVSE cannot turn off safety devices in idle mode, while still actively ready to respond to the EV. This is required by NFPA's NEC, and UL safety standards in the United States. If given a choice between Personnel Safety and EPA Energy Standards, we certainly hope the industry chooses SAFETY of PEOPLE first.

EVs will turn the EVSE's contactors on and off at will, and often many times for each connection cycle. This is a basic function of the SAE-J1772 standard and cannot be deviated from or the EVSE will no longer function properly.

As a practical matter, EVs turn off the contactors whenever they stop needing power. So, the EVSE spends very little time in Idle Mode as defined by the standard. Requirements for this mode should be eliminated.

4. Do not dictate Contactor Energy Loss

There was much discussion about the energy consumption of the main contactor in the EVSE during the last Webinar.

The quality and properties of the contactor is dictated by electrical safety standards from Underwriters Laboratory UL2594 standard and the NFPA's NEC 625. Contactors and relays must be utilized in the main control path to the EV, electrical safety standards dictate this.

Energy Star should not set a minimum standard energy consumption for these switching devices. They are sourced from off the shelf UL listed components that are built for durability under short circuit conditions, reliability with regards to the lifetime on/off cycles of the product, and speed of disconnect in order to meet Safety requirements. The bigger the contactor is, the more reliable and SAFE it is.

Setting a low threshold of energy loss for the contactor would only force EVSE manufacturers to undersize one of the critical functional safety components of the system. Lower power contactors are lower quality and lessor capable contactors. It would be undesirable for industry to be required to reduce safety and durability in order to obtain an Energy Star rating.

The EPA proposed 0.25 * Max Current = MaxWatts relay power consumption may be a reasonable solution, however ClipperCreek staff has not had time to investigate, the timeline for comments due 9/26/2016 from a Webinar on 9/15/2016 was too short.

5. Require any EVSE to be NRTL certified as a criteria for Energy Star Rating

ClipperCreek recommends requiring NRTL certification of any equipment before it can receive an Energy Star rating. The basic function of the device is to safely extend 240VAC wall voltage to the EVSE. The construction and operation of the EVSE is highly dictated by the NFPA NEC section 625 and UL safety standards. These standards are not optional. They are absolutely required for certification and safe operation for protection of personnel against electric shock and fire.

The EVSE is a high power electrical safety device. Only products with OSHA certified NRTL certification should be considered as candidates for an Energy Star Rating.

There was some discussion that E* does not want to pick safety standard winners and losers. You can be assured there is only ONE standard that is accepted in the US. It is the NFPA code panel 12 that sets the National Electric Code section 625 Electric Vehicle Charging and Supply Equipment. The UL standards for UL2594 are derived from the article NEC 625. This standard has been established as the tri-national (Mexico, USA, and Canada) harmonized electrical safety and test requirements for EVSEs.

It would be possible for a manufacturer to build a substandard product that has not been 3rd party safety certified by and OSHA certified NRTL but still meet Energy Star requirements. For example, a product could be built with the bare essentials to simply trick the vehicle into charging, but otherwise would have no safety functions, and inadequate protection against fire and electric shock.

It would be our opinion that meeting Energy Star requirements would be easier if the product did not have to meet the regulatory safety requirements, since no 3rd party NRTL would have certified the presence and effectiveness of various sensors and components, thereby reducing power loss. It would be undesirable for the Energy Star mark to be associated with such equipment. Customers could be confused because the perceived quality of a non-safety certified product could be elevated by the Energy Star mark appearing on a product that otherwise does not meet established safety requirements.

6. Increase base allowance to 5W, 2.6W is too low to meet new safety requirements

ClipperCreek recommends increasing the base allowance to at least 5W. The industry is not mature, the products are not mature, and the safety standards increasing in the future. There are new safety requirements coming into the industry, required by customers and the NFPA/NEC which increase the minimum safety functionality, and the corresponding minimum power consumption.

ClipperCreek is in the preproduction stages of a next generation product to meet some of these new standards. The baseline consumption of this product is already over 3W. There is no enhanced functionality for this device. It is a minimally featured product. Just the minimum functionality needed to meet the new required functional safety standards has already pushed the baseline consumption over the 2.6W threshold. None of these safety features can be eliminated or turned off.

7. Basic EVSEs such as L1 cord sets and non-communicating L2 are Functional Safety Devices like a GFCI

EVSE may appear to be "consumers of power" for the purposes of "charging" electric vehicles, however that is simply not the case. The primary function of the EVSE is to provide a safe extension of the electrical service from the wall to the vehicle. Standards for EVSEs have been established for over 20 year in order to protect personnel against electric shock and fire.

Common place examples of other products in the market that serve the same function as an EVSE are shown below

Figure 2 and **Figure 3**. Perhaps these product do not look like EVSEs, but they are governed by standards from which EVSE standards are derived and perform nearly identical functions. Energy Star should not set standards for products that are basic safety devices that are in line with power transport conductors.

With regards to the energy consumption of the EVSE when in or out of the charging mode, functionality is all about addressing safety risks, as it would be with the GFCI cord set shown in

Figure 2. There are several basic safety functions that must be continuously operational in order to meet UL standards and the NEC. It would not be a good practice to attempt to turn off these functions even when the cord set is not actively charging, and is not allowed by the UL safety standards. It would clearly be a reduction of safety for the end user. Energy Star certification should not require the reduction of safety in order to meet the energy loss requirements.

For example, two of the critical functions that cannot be turned off are the 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.

Most of the energy consumption data presented in **Figure 1** are for basic units as described. Generally, they are already optimized for low energy loss in non-charging modes. Only unit 4 is a non-basic unit. Setting the energy level as low as 2.6W may well serve to do nothing more than penalize manufactures with product equipment types the industry needs, such as basic 32Amp charging stations and encourage manufacturers to reduce safety critical monitoring. This would only serve to make the products less safe. Safety is the primary function.

Figure 2 GFCI Safety Device Inline

Figure 3 Ground Faulting and Power Control for SPA

Summary

The EVSE market is in its infancy. Burdening the products unduly will have the effect of oppressing innovation. Energy Star staff emphasize the standard will evolve over time. Do not set the bar so low to start with that only non-safety certified stations with no advanced features can meet the requirements. This will also lead to low industry participation in the program, which is counter to wide spread adoption.

ClipperCreek would encourage Energy Star staff to continue dialog with the industry and break the standards into more power levels with consideration for specific applications along with a temporary carve out for basic Level 1, basic Level 2, and utility centric communication systems.

ClipperCreek asks that accuracy of the data sets collected be presented for industry review.

ClipperCreek asks that the products from which the data was collected by a 3rd party testing lab be presented for industry review.

It appears that the 2.6W was established in part based on incorrect accuracy assumptions of the data. ClipperCreek's data was presented with an accuracy of +/- 1W to Energy Star but was evaluated to a 10th of a Watt or even more precise.

ONLY safe NRTL listed products should be considered for application of the Energy Star mark.

Cost justifications for base Idle State and Partial On Mode needs to be presented to justify the impact to the consumer, given the potentially deceptive assumption by the consumer that they are saving energy at the EVSE when in fact it is wasted by the vehicle more than 100 times as much.

Thank you for the opportunity to comment.

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