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Truck Stop Electrification Codes and Electrical Standards; Notice of Data Availability [FRL-7783-3]: Summary of Comments

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Transportation and Regional Programs Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

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Truck Stop Electrification Codes and Electrical Standards;
Notice of Data Availability [FRL-7783-3]
Summary of Comments

Commentors:

1) Caterpillar, Inc.
2) ConocoPhillips Alaska, Inc.
3) IdleAire Technologies Corporation
4) National Electric Transportation Infrastructure (IWC)
5) Phillips and Temro Industries
6) Shurepower
7) State of Missouri Department of Natural Resources
8) Truck Manufacturers Association (TMA)
9) Washington State Department of Transportation

Potential TSE Code and Electrical Standards

Note: One commentor submitted a draft standard for TSE as part of their comments. **(4)**

General Comments:

- Mexican standards for connections may be an additional area of interest given the large number of trucks that may pass through our southern borders. **(9)**
- The location of oilfields in the remote arctic requires operation of diesel trucks on a 24-hour basis during cold ambient conditions, which is a large part of the year. In addition, the North Slope oilfields do not have enough power generation capacity to support the TSE initiative envisioned by EPA and the U.S. Department of Transportation. We request that EPA clarify in future rulemaking that the TSE initiative is not meant to apply to industrial applications such as ours, particularly in arctic conditions on the North Slope of Alaska. **(2)**
- We would like to express our support for the effort to develop uniform national standards for truck stop electrification (TSE) infrastructure. As the number of manufacturers and users of TSE technology grows, the lack of uniform standards could lead to stranded investments, damage to TSE equipment and, worst of all, safety hazards. **(7)**

On-Board System Power Needs

- **What is the kW power needs? Is it <3 kW, 3-6 kW, or >6 kW?**
  - Power availability ranging from 3-6 kW is needed **(6), (5)**
  - Based on analysis and study of class 8 trucks equipped with sleeper cabs, and considering future trends, we recommend 5kW (with some allowance for power factor due to lagging loads, to arrive at 7.2 kVA). **(1)**
  - It depends primarily whether the truck is used extensively in cold weather environments, in which case, it is likely to be equipped with a block heater, as

well possibly, with an oil sump and fuel heater. Peak loads without this equipment can range to over 7kW; with this equipment, the figure can increase to over 10kW. **(8)**

- Over 3 million hours of service data has been compiled into a forecasting model to project TSE power demands under varying weather conditions. This empirical evidence shows that TSE, taken in terms of a national average, requires an annual power demand of 1.25 kW per space to maintain comfort and provide needed power to accessories. Peak power draw by definition is greater than this nationwide average. Under conditions of extreme cold, the maximum power draw/peak load could reach or exceed 6kW per space. **(3)**

- **Describe the types of devices and their kW needs when operated?**

  - HVAC – heater (2.5/5kW), AC compressor (1.5 kW), fans (.2 kW)
    Interior Electronics - .2 kW
    Block Heaters – 1.5 kW (@120Vac) **(3)**
  - A/C compressor - up to 4 kW, electric heat up to 3kW, battery charging 0 - 3kW, blowers & lights 0 - 1 kW. Appliances up to 2 kW. **(1)**
  - HVAC 1.2 – 2.5 kW; Block Heater 1.0kW -1.5kW; Lights .200kW; Oil Pan Heater .150kW-.300kW; Microwave 1.0 kW ; Refrigerator .140kW; Fuel Heater 1.0 kW; Television .150kW ; Fuel/Water Sep 0.06 kW **(5), (6)**
  - Television 0.75 kW**;** VCR or DVD 0.75 kW**;** Refrigerator 0.180 kW**;** Microwave 1.4 kW**;** HVAC 4.4 kW**;** Blockheater 2.5 kW**;** Fuel heater 0.350 kW**;** Battery charger 0.60 kW **(8)**

- **Should we use peak power needs?**

  - No. **(1)**
  - Yes. **(6), (8)**
  - Duty cycle graphs of equipment demand versus most probable maximum occupancy and/or weather should be incorporated into the power needs to provide a reasonable value for expected power demand. An example of this can be seen in Article 220 of the NEC where demand factors are applied to design loads. Demand factors for TSE should be developed that take advantage of empirical data and allow for reasonable design constraints. **(3)**

- **Should we follow existing codes for feeder and demand calculations or does this technology warrant specific codes to follow?**

  - Since current NEC guidelines do not take into consideration the unique characteristics of TSE, it should be considered part of the TSE implementation to also develop specific codes within the NEC. **(3)**
  - Yes. **(1)**
  - Standard land-side wiring standards and practices are likely to be sufficient.

Precautions need to be taken, however, to design wiring, receptacles, and plugs to quickly disconnect and be electrically protected if a driver inadvertently pulls away without disconnecting the plug**. (8)**

- **What are the future trends?**

  - Future trends should be those that allow for truck accessories (including HVAC) to be connected to AC shore power. **(3)**
  - As land-based connections become more prevalent, the number of components and power requirements may increase. Drivers will acquire additional components to match the comfort and convenience of their homes. **(6)**
  - There is a trend to accumulate and use more electrical devices, which is partly offset by many appliances being designed with higher energy efficiencies. The new hours of service are expected to have an impact on the trucking industry and TSE. Trucks will need electrical power for cab temperature control (heating or air-conditioning), PLUS, electrical power for entertainment. (**1)**
  - Future trends are as follows: Dedicated truck stop parking spots will be increasingly hard to find at locations where drivers want to stop, thus, stand-alone solutions will be increasingly important; Public displeasure with idling trucks will increase; Fuel and engine maintenance costs will continue to increase; therefore truck operator demand for these technologies will increase; Just-in-time delivery operational demands and hours-of-service rule changes will make stopping at remote truck stops less appealing. Drivers will want to stage their stops very close to origin and destination points; Demand for internet and entertainment connections is increasing, as is demand for full household capabilities (water & sewer). **(8)**
  - Future trends will most likely see hotel and vehicle power loads combined under a single load. **(5)**

- **Will power needs increase or decrease?**

  - It appears that peak power needs will decrease as more efficient methods for placing equipment on-board are developed. An example of this would be the decreased thermal loss when delivering HVAC directly from inside the truck. However, the overall average power needs inside the truck could increase (from the current 1.25 kW/space) as drivers become aware of more uses for AC power in the truck cab. **(3)**
  - Power demands will likely increase. **(5), (8)**
  - Demand will likely increase, but be partially offset by using increased capabilities in power management systems and by leveraging and using on-board battery systems during transient peak electrical power demands. **(1)**
  - Even if the components increase in the cab, measures can be taken to decrease power demand. Although the total and average demands may increase, existing technologies can drastically reduce the peak loads **(6)**

ii. Off-board Power Needs

General Comment: We suggest that the evaluation also account for power constraints that may be present at public rest area facilities (perhaps standardized 120V or 240V). **(9)**

- **What voltage and amperage configuration will supply the off-board needs? Should it be 120V, 240V single phase, 280V single phase or some other voltage?**

  - Recommendation for use of 120-volt and 208-volt AC power. **(3), (4)**
  - We recommend that initially two 120VAC - 20amp and one 120/208VAC – 30amp outlets be available to drivers. If future trends dictate that all OEM manufacturers are supplying the120/208VAC connection, a shift to exclusively providing the higher power outlet will be considered. If a 120/208 VAC – 30amp connection is provided, the block heater wiring can be integrated into a single plug. **(6)**
  - Single phase 240-Volt AC at 30 amps, and use of a 4 wire configuration is recommended. **(1), (5)**
  - It is clear that we need to design our products to enable our customers to simultaneously use as many 120V AC "household" items as possible. A significant hurdle, however, is the need, in many cases, to be able to also power engine block, oil sump, and fuel heaters (in winter) and HVAC (in summer), all which run on 120V AC. A better solution would be to leave the engine block, oil pan, and fuel filter heaters on a separate 120VAC connection. **(8)**

- **What amperage configuration will best provide the power requirement? Is it 20, 30, 50, or some other amperage?**

  - 30 amp service. **(3), (8), (5)**

  - Recommend that initially two 120 V-20 amp and one 12/208 V-30 amp outlets be available to drivers. **(6)**

- **What are the power needs for the transportation refrigerator units?**

  - "Interior-hauling" vehicles (those that transport goods to the Interior US) that have the capability to connect to shore power, use 208/3/30 for the required shore power connection. **(3)**
  - Inquiries to the major TRU manufacturers indicate that most TRUs can be configured to accept 208VAC 3-phase power.**(6)**
  - We defer to our colleagues at the Truck Trailer Manufacturers Association for the answer to this question. **(8)**
  - Large trailer reefers require a much higher power level than needed for truck cabs for hotel loads. A 30 kW reefer unit parked in the sun needs 30 kW.**(1)**

- **Will a voltage above 120V present problems for existing heaters on the market? Or does this emphasize the need for truck OEM's to install integrated block heaters into the TSE design?**

  - Any change in the current power requirement of an automotive component will cause "problems" in the market. The need to move away from 120Vac for block heaters seems insignificant due to 120Vac always being necessary inside the truck (for accessories) and for the minimal improvement in efficiency by moving to higher voltages on block heaters. In either case, the TSE shore power distribution would be designed to offer either 120Vac or 208Vac. **(3)**
  - Voltage above 120 V will present problems for existing heaters on the market.**(8)**
  - We recommend that trucks continue the long-standing practice of plugging in a separate 120 V cable for the engine block heater to handle extreme cold conditions. **(1)**

iii. Connection Compatibility and Safety

General Comment: If RVs and trucks are meant to have compatible connections, then competition between vehicle types for space may be an issue. Also, if public rest areas are used for electrification, foolproof systems of connections (or connection indicators) are needed so that pulling away without disconnecting would not harm persons or equipment **(9)**

- **What plug configuration should be used?**

  - There are two pedestal outlet configurations that will meet most truck needs and will use readily available and proven plug configurations.
    - The first configuration is all 120VAC and has two 20 amp GFCI outlets and one 30 amp ground outlet. The 30 amp outlet is NEMA TT-30R, which is used by a majority of RV's. One of the two 20 GFCI outlets is used for vehicle (block heater) loads while the other is used for small HVAC.
    - The second configuration will see the inclusion of a NEMA 14-30R outlet. The outlet has 4 wires with 2 hot 120VAC connections, a ground and neutral. **(1), (5)**

  - It will be necessary and appropriate to consider using a twist/lock style plug that will only energize if/when properly installed. Something capable of delivering 208Vac and up to 30 amps will be needed to support TSE**.** We suggest exploring a TSE-specific configuration, with breakaway capabilities. **(3)**

  - We recommend two outlets with the dual (or "T") configuration that can accept either 15 or 20 amp 120VAC plugs (NEMA 5-15P or 5-20P). This outlet should accommodate either plug and be rated at 20 amps. We

recommend either a 120/240VAC or 120/208VAC NEMA approved receptacle rated for 30amps (over 6kW total power). **(6)**
- Currently, a standard 3-prong plug is most widely used. If in the future, a 240 VAC line at 30 amps is provided, a standardized plug should be used. **(8)**

- **Should the block heater connection be considered as part of the truck-mounted TSE system?**

  - No. **(1), (8)**

- **Should power management be required, and if so where should it be installed, on the truck or within the connection facility?**

  - Although power management should be a design requirement for the truck and the facility, it will be imperative that the facility is designed to handle power distribution to all variations of truck designs in a safe manner. **(3)**
  - Power management should be installed within the TSE facility. **(8)**
  - If power management or "load management" is to be recommended or required, it should be located on the vehicle **(6)**
  - A power manager controller will be required to handle(manage) the electrical power needs. Its location needs to be on-board the truck so that power management schemes can be tailored to best address the needs, or the devices, that the customer has installed and is using. **(1)**

- **Should multiple configurations be available on a percentage of use basis, as is done at RV campsites?**

  - No. **(1), (3)**
  - It is reasonable to expect that users would be charged on the basis of how many lines/circuits they used and only be charged for the power they consume **(8)**

- **How should the user be required to interface with the TSE system for questions and payment?**

  - The user interface should take place inside the truck. However, it could be said that this aspect of TSE is not one that should be within the codes and standards but instead up to the facility. **(3)**
  - NY's TSE sites are demonstrating a payment system that addresses customer needs. A kiosk or ATM station should be utilized that accepts credit/debit/or fuel card payment, which activates the pedestal for the select number of hours **(1)**

- **What type of safety considerations should be included in developing the TSE system?**

  - Grounding standards, in addition to normal safety considerations, must limit interference with onboard electrical and electronic systems**.(8)**

- Ground fault protection, over-current protection, weather-proof plugs and receptacles. **(1)**

- **Which grounding standard should be adopted for truck on-board and facility systems?**

  - UL/CSA **(6), (8)**
  - The truck frame should be grounded and GFI circuitry implemented **(1)**

- **Should power be distributed in any certain manner?**

  - It should only be required that all codes and safeguards are followed recognizing the design setting…the truck stop environment. **(3)**
  - We believe this is best left to the truck OEMs and suppliers of idle reduction systems **(1)**
  - GFCI and circuit protection should exist at the power source and/or on the vehicle. General safety standards as recommended by NEC and local codes should also be followed. **(6)**

- **Should power be available at any distance away from the vehicle?**

  - There may be an occasional need/desire to operate some 120VAC electrical devise outside a parked vehicle **(8)**
  - Any TSE design should allow for safe user interface via delivery module or cord so long as the distance from the truck to the TSE interface is within an allowable distance for proper power distribution. **(3)**
  - Distribution should be limited to avoid excessive voltage drop and cable size. The national TSE code/standard needs to address pedestal designs **(1)**

- **Should electrical safety measures (GFCI, fuses, breakers, etc.) be present on the truck, at the connection facility, in the connection wiring, or a combination of these?**

  - Combination as needed for safety **(8)**
  - Electrical safety must be addressed on all locations of the truck and facility. **(3)**
  - The safety measures should be installed at the connection facility **(1)**

- **What sort of safeguards should be in place to verify that the driver only energizes his/her parking space?**

  - "No Pay/No Power" requires that the driver not only attempt to pay for service but is also approved first before power is supplies to any connection to the truck. This also would require that the system be designed such that payment/transactions cannot begin unless the user has plugged in properly. **(3)**
  - TSE systems should be "safe" regardless of whether power is energized or not **(1)**

- **What safety measures (like auto-eject connectors or break-away connections, engine/transmission/emergency brake system interlocks, visual indicators, or other equipment) should be integrated into the TSE system to prevent structural damage, should users pull away while still connected?**

  - All aspects of the design that interface with the driver should incorporate breakaway features **(3)**
  - Break away cord or plug **(5), (6), (8)**
  - Safety measures should be added into the pre-trip installation **(8)**
  - Perhaps a lock box or lock-out device **(5), (9)**
  - One of the following safety measures should be required:120VAC –15&20amp cords; Auto-eject connectors; Transmission or brake interlock; or Visual (dash indicator) and audible (buzzer/chime). An auto-switching device (between onboard and off-board power sources) is recommended when the vehicle is capable of generating its own power. **(6)**
  - It should be left to the truck OEM, provider of idle-reduction solution system, and the customer. A number of measures could be used, such as eliminating engine starting and/or parking break release, to activating warning lights and horns, if the vehicle engine is started with TSE connected. We also recommend a cable in-line breakaway connector be used to minimize damage to both the pedestal and the truck mounted outlet. This in-line cable breakaway connector should be approximately 2 feet from the truck mounted connector or at a length so as not to drag on the ground by a moving truck. **(1)**

- **Should tamper-loop monitoring be required?**

  - Yes. This aspect of the design is far too "easy" and sensible to not be considered a requirement. The "Monitoring" of this system is paramount and forces TSE implementers to ensure that they have systems in place to watch and manage the power distribution safely. **(3)**
  - No. **(1)**

- **Are standards required to ensure safe power supply switching between on-board and off-board power sources?**

  - It should only be required that services are not offered until proper connection is established and payment of service is verified **(3)**
  - Yes, there is a potential for 3 separate AC power sources: 1. TSE 2. APU 3. AC Inverter **(1)**
  - Generally accepted design practice dictates that if a method of powering the 120 VAC system is on board the truck, the system will automatically detect power at the land connection and disconnect the onboard 120 VAC power source **(8)**

- **Should open service neutral protection be standardized on truck mounted systems?**

- Yes. **(1), (3), (8)**

iv. System Design

General Comment: The electrical grid standards for truckstops should be shown in the NEC article 551 much in the same manner as those for RV parks and marine boatyards. The electrical standards for trucks themselves should be written as a SAE Recommended Practice. **(5)**

- **What steps should be taken to ensure that modularity of both the truck-mounted and facility-based TSE is ensured?**

  - Implementation of national codes/standards will help promote and ensure this. **(1)**

- **How should wiring systems of the truck-mounted systems delineate AC and DC wiring or high and low voltage wiring (color-coding)?**

  - We are not aware that any standard color coding exists for this purpose**.(8)**
  - Recommend use of bright orange coloring for the high voltage DC wiring, such as the SAE hybrid vehicle standard. **(1), (6)**

- **What location on the truck (incorporating safety, visibility, and user preferences) should be designated as the standard location for the installation of the truck-mounted TSE connection (e.g., driver side, passenger side or front of vehicle, fender or cab area)?**

  - Because of the high traffic on the driver-side of the truck (trucker coming and going) it seems most appropriate to keep any and all connections on the passenger side. **(3)**
  - TSE connection should be on the driver's side **(1), (8), (6)**

- **How should cab design issues be approached when determining the impact on cab power requirements?**

  - If cab power requirements can be lowered by making reasonable standards for truck OEM's, it should be considered most beneficial for both truck and facility to address those areas inside the cab. One simple example of this would be a requirement to reduce truck window glass emissivity in the interest of lowering HVAC loads inside the truck due to radiation. **(3)**
  - OEM's should be encouraged to better insulate cabs. This would help with both sound and thermal efficiency. **(1)**
  - The availability of information about the thermal insulation properties of various manufacturer's' sleeper berth designs can help drivers/truck buyers decide how much power they will need to heat/cool these units. **(8)**

- **Should a standardized cab living space be identified to determine the vehicle electrical load requirements (heating, ventilation, and air conditioning [HVAC] system capability and cab insulation levels)?**

    - Only for the upfront TSE design parameters should a "standardized cab living space" be identified. These minimum standards should be set in place to ensure efficient use of TSE, but the OEM's should enjoy the ability to design trucks to meet market demand. It is reasonable to assume that over time, as TSE gets deployed, market forces would drive the adoption of cabs designed to take maximum advantage of TSE, and would drive OEM's to improve such features as cab insulation. Here again, for design and recommended practice purposes, it seems reasonable to average the OEM cab living spaces for items such as "average volume," "average window area," "average overall insulating coefficient," "average infiltration rate," etc. to allow for design load requirements to be estimated. **(3)**
    - No. **(1), (8)**
    - No, however it may be beneficial to recommend a certain maximum heat loss/gain rate through the cab envelope to reduce the average HVAC loads. **(6)**

- **What weight allowances should be permitted for truck-mounted TSE equipment?**

    - Implementing a weight allowance for TSE and idle reducing systems would provide an incentive to truck owners to add the idling reduction systems with the knowledge they would not lose truck payload capacity. This would mean that the current truck class weight limits would need to be raised for trucks with truck mounted TSE or idle reduction equipment. **(1)**
    - The added weight of this equipment could approach 100 lbs. **(8)**
    - Idle reduction technologies in general often increase the weight of the vehicle. The 250 pound weight exemption request for idle reduction technologies in the Energy Policy Act of 2004 should be sufficient for on-board related TSE hardware **(6)**