



Electric Drive Vehicle Systems: Suggested Changes to Large Truck and Motorcoach Regulations and Inspection Procedures

Most commercial vehicles on the road today use low-voltage electrical systems (12/24 volts direct current). The current Federal Motor Carrier Safety Regulations (FMCSRs), North American Standard (NAS) inspection procedures, and out-of-service (OOS) criteria do not address the unique safety aspects of high voltages (greater than 60 volts direct current or greater than 30 volts alternating current) when present on a commercial vehicle. The purpose of this project was to identify suggested changes to the current FMCSRs and inspection procedures to address the unique safety requirements associated with high-voltage vehicle systems and to improve

the overall safety of commercial vehicle operations. A summary of the recommended changes to the FMCSRs, NAS inspection procedures, and OOS criteria can be found in Table 1.

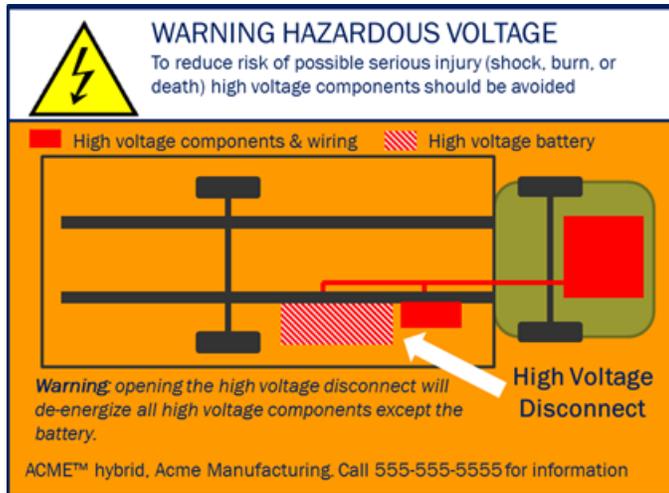
PROCESS

The growing number of high-voltage vehicles prompted FMCSA to begin a review of current FMCSRs that are applicable to the electrical drive systems in commercial vehicles. This review focused on identified FMCSRs with aspects that would potentially be different for high-voltage systems as compared to low-voltage systems.

Table 1. Summary of recommended changes.

| Category | Recommended Areas for Consideration |
|--|--|
| Labeling | Minimum labeling requirements for in-use electric drive commercial vehicles (see Figure 1 for an example). |
| High Voltage Isolation Detection | Minimum requirements for detecting isolation of high-voltage systems on commercial vehicles. |
| In-use Condition of the Rechargeable Energy Storage System (RESS) (Battery Pack) and High-voltage Components | Minimum standards for in-use condition of the RESS (battery pack) and high-voltage components on commercial vehicles. |
| Accident Reporting | Include additional information about reportable accidents involving electric drive commercial vehicles in current accident reporting requirements. |
| Driver Inspection Checklist | Include the RESS and other high-voltage components in the list of vehicle parts and accessories to be checked during daily driver inspections of electric drive commercial vehicles. |
| NAS Inspection Procedures | Modify the NAS inspection procedures for electric drive commercial vehicles. |
| Vehicle Repair Orders and OOS Criteria | Address vehicle repair orders and additional OOS criteria for in-use electric drive commercial vehicles. |

Figure 1. Image. Mock-up of high-voltage service disconnect label.



Following the review of regulations, the researcher conducted a literature review of codes, standards, and best practices related to high-voltage electrical systems on medium- and heavy-duty vehicles.

Using the review of current regulations and the literature review for reference, the researcher identified gaps in the current FMCSRs, NAS inspection procedures, and vehicle OOS criteria that leave the unique safety concerns of high-voltage vehicle electrical systems unaddressed. Based on this gap analysis, the researcher developed a preliminary list of recommended changes to the FMCSRs, NAS inspection procedures, and OOS criteria to address the identified gaps.

With the FMCSA project manager, the researcher then conducted a series of industry site visits/consultations to gather feedback on the preliminary recommendations from a representative sample of organizations that would be most affected by the preliminary list of recommended changes. These organizations fell into four groups: (1) original equipment manufacturers (OEMs) of electric drive commercial vehicles, (2) major component suppliers to the OEMs of electric drive commercial vehicles, (3) major fleet owner/operators of electric drive commercial vehicles, and (4) commercial vehicle enforcement and inspection organizations.

RECOMMENDATIONS

To strengthen the regulations and to ensure that battery-electric, hybrid-electric, plug-in hybrid-electric, and fuel cell commercial vehicles will be maintained and operated in a manner that provides the highest level of public safety according to the best practices that now prevail, this report makes a number of recommendations for changes (see Table 1). These recommendations are based on the literature review and gap analysis, taking into account feedback gathered during the site visits/industry consultations and considering comments received from peer reviewers. The voluntary standards and best practices articulated in Society of Automotive Engineers (SAE) J2910, “Recommended Practice for the Design and Test of Hybrid Electric and Electric Trucks and Buses for Electrical Safety” are the starting points for most of the recommendations.

As with the current FMCSRs, the proposed changes would apply to all in-use commercial vehicles subject to FMCSRs (i.e., those used in interstate commerce) whether manufactured with high-voltage electrical systems by OEMs or converted to electric drive operation by a vehicle owner or a third party. Note that a commercial vehicle does not necessarily have to cross State lines to be in interstate commerce; if the passengers or carrier cargo cross a State line, the commercial vehicle is involved in interstate commerce. Individual States have the option to adopt the FMCSRs. In this case, an individual State would apply the applicable FMCSRs to all commercial vehicles operating in the State, including vehicles used exclusively in intrastate commerce.

To read the complete report, please visit:

http://ntl.bts.gov/lib/56000/56200/56288/14-007-Electric_Drive_Systems-FINAL-NOV_2015.pdf