



# Commercial Vehicle Safety Alliance

North American Standard Inspection Program

## INSPECTION BULLETIN

2015-06

April 16, 2015

### Electric-Drive Commercial Vehicle Inspections

#### Summary

The purpose of this safety bulletin is to educate inspectors about the hazards of high voltage in electric-drive commercial vehicles.

#### Background

There are over 10,000 electric-drive medium-duty (Class 4-6) and heavy-duty (Class 7-8) trucks and buses in North America. Electric-drive commercial vehicles have been in use since the late 1990s. With many potential environmental, functional, and economic benefits, electric-drive systems are becoming more popular in commercial vehicles. There are several different types of electric-drive commercial vehicles: battery (also called a rechargeable energy storage system), hybrid-electric, plug-in hybrid-electric, and fuel cell. Today the most common electric-drive commercial vehicles are hybrid-electric transit buses, hybrid-electric utility trucks, hybrid electric tractors, and hybrid-electric and battery-electric box trucks used for local and regional deliveries.

#### Difference between Low- and High-Voltage Electrical Systems

It is not possible to describe each type of electric-drive commercial vehicle in this bulletin; however, virtually all types of electric-drive commercial vehicles have a high-voltage electrical system and a low-voltage electrical system. The main difference between the electrical systems of an electric-drive and a conventional commercial vehicle is that the electric-drive commercial vehicle uses both high- and low-voltage electricity and the conventional commercial vehicle uses only low-voltage electricity. The typical low voltage system in a commercial vehicle is 12/24 volts direct current (VDC) and can run as high as 42 VDC. Human contact with low-voltage does not cause serious injury or death. A high-voltage system is defined as an electrical system with 60 or higher VDC or 30 or higher volts alternating current (VAC). The typical electric-drive commercial vehicle includes a high voltage system operating anywhere between 300 and 800 VAC. Human contact with high-voltage (VDC or VAC) can result in serious injury or death (i.e., electrocution). This is why inspectors need to be aware of potential hazards when dealing with an electric-drive commercial vehicle, and take precautions to avoid electrocution.

## INSPECTION BULLETIN

2015-06

April 16, 2015

## Electric-Drive Commercial Vehicle Inspections

**Identifying an Electric-Drive Commercial Vehicle**

There is no regulation that requires electric-drive commercial vehicles be labeled to alert first responders to potential electric shock hazards, except in the State of New York. (The State of New York requires the label shown in Figure 1 for electric drive transit buses; this label may not necessarily be perceived as a warning.)



Figure 1: New York State required label for electric-drive transit buses.

Industry best practices call for manufacturers and fleet owner/operators to label such vehicles. For example, the Society of Automotive Engineers (SAE) J2910 calls for electric-drive heavy-duty trucks and buses to bear a warning label on the front and side of the cab which consists of a yellow triangle with a black thunderbolt (see Figure 2).

This is one way that inspection personnel may use to infer that a commercial vehicle has a high-voltage.



Figure 2: International Electromechanical Commission label (IEC60417) for high voltage (yellow triangle with black thunderbolt).

Another way to identify electric-drive vehicles is via manufacturer “badging” or company “branding.”

## INSPECTION BULLETIN

2015-06

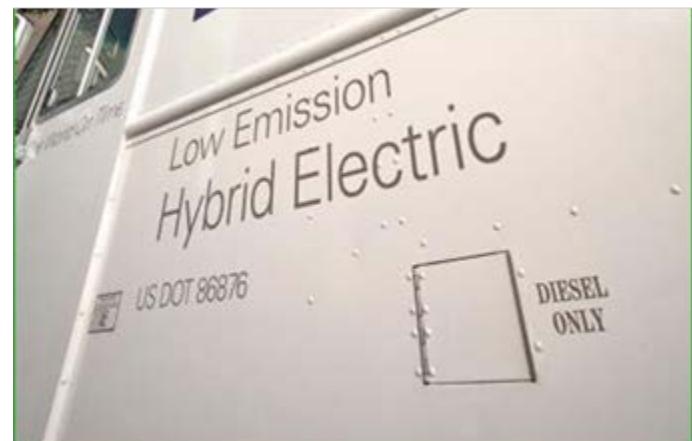
April 16, 2015

## Electric-Drive Commercial Vehicle Inspections

Figure 3 is an example of badging by the original equipment manufacturer of the truck, and Figure 4 is an example of branding by the fleet owner/operator of the truck.



**Figure 3: Example of badging: circular blue-green “Hybrid” badge affixed to truck cab door by the Original Equipment Manufacturer.**



**Figure 4: Example of branding: “Electric-Hybrid Vehicle” placed by the fleet owner/operator on the side of truck.**

Additional indicators that inspectors may use to determine that a commercial vehicle has high voltage are labels on compartments that bear the warning “High Voltage” (see Figures 5 and 6).



**Figure 5: Example of High-Voltage Warning Label.**



**Figure 6: Example of High-Voltage Warning Label.**

The presence of orange colored insulation on electrical conduits or cables (see Figure 7) is an indicator for inspectors that a commercial vehicle is equipped with high voltage.

## INSPECTION BULLETIN

2015-06

April 16, 2015

## Electric-Drive Commercial Vehicle Inspections



SAE J 1673 calls for the orange color to be used on all high voltage cables on all vehicles. [This is not to be confused with orange color extension cords, which are for purposes of visibility to denote a potential trip hazard] or orange-colored electrical outlets, which are for purposes of convenience to denote isolated-ground circuit [where sensitive electronics can be plugged in.]

**Figure 7: Example of orange-colored cable on an electric-drive commercial vehicle.**

### Precautions to Take in the Presence of Electric-Drive Commercial Vehicles

To avoid the danger of electric shock, inspectors should take the following precautions when around electric-drive commercial vehicles:

- Do not touch or come into contact with any exposed copper wires from orange cable or conduit, or inside compartments marked "High Voltage" (Figures 5 and 6) or labeled with a yellow triangle bearing a black thunderbolt (Figure 2).
- Do not pull or tug on any wires coming out of orange conduit, or out of compartments marked "High Voltage" or labeled with a yellow triangle bearing a black thunderbolt.
- Do not attempt to open any compartment marked "High Voltage" (Figures 5 and 6) or labeled with a yellow triangle bearing a black thunderbolt.
- Do not poke fingers, screwdrivers or other tools into any holes, cracks, crevices, or openings in compartments marked "High Voltage" or labeled with a yellow triangle bearing a black thunderbolt.
- Do not touch any liquid that may be exuding from a battery (also called rechargeable energy storage system) (regardless of low or high voltage).
- Do not smoke, use any heat-generating, igniters, or sparking devices near a battery because the electrolyte in the battery (i.e., some types of rechargeable energy storage systems) may be a flammable liquid.
- Do not inspect a vehicle that has a "High-voltage fault" or "Stop hybrid" or "Stop System" red light illuminated on the dashboard that could indicate loss of electrical isolation in the high voltage system. (these vehicles should not be operated).