The new fire risks associated with EVs and HEVs

How do we minimize them?

by Jonas Bergström, business manager at Dafo Vehicle Fire Protection's bus and coach division

This new Solaris Urbano 12 electric bus was photographed in Hamburg, Germany on Ludwig-Erhard-Strasse in front of St. Michael's Church. While electric buses may look similar to diesel buses externally, their fire hazards are substantially different. Solaris builds buses in Poland and offers a wide range of transit buses. SOLARIS.

With a growing coalition of countries pledging to reach climate change targets of net-zero emissions, the world is seeing a massive transition to renewable fuels. As a result, the automotive industry is changing to meet growing demand for electric and hybrid public transport vehicles. Jonas Bergström, business manager at Dafo Vehicle Fire Protection's bus and coach division, assesses current and new vehicle fire risks as the automotive industry moves towards electrification, and explains how vehicle operators can minimize these risks.

Recent Developments Europe

The United Nations Economic Commission (UNECE) introduced Regulation 107 to impose stronger bus and coach safety regulations. Under these regulations, engine vehicles are legally required to have an automated fire suppression system in the engine compartment. However, UNECE Regulation 107 does not discuss the fire hazards brought about by lithium-ion batteries used in electric vehicles (EVs) or the electric component of hybrid electric vehicles (HEVs).

Currently, it is not a legal requirement for vehicles without internal combustion engines (such as EVs) to be equipped with automated fire suppression systems. The drawback of this is that, in the event of a fire, the manual extinguishing function and external system may need to operate together, which can escalate the spread of fire and increase downtime.

The latest draft of UNECE Regulation 100 (Construction and Safety of Electric Powertrains) was issued in 2020 and recommends an early warning signal in case of battery failure in rechargeable electrical energy storage systems (REESS), especially where there is risk of thermal runaway. Thermal runaway is where a battery cell defect – caused by overcharging, overheating, overvoltage or physical damage – leads to rapid temperature increases, and higher risks of potential explosions, fire and toxic gas emissions.

In order to recognize potential battery failure at the earliest possible stage and

reduce the risk of a fire, in line with Regulation 100, fire suppression systems could be used as an additional safety device to discharge a cooling agent to minimize hazardous risks. In Annex 8E, UNECE Regulation 100 recommends fire testing REESS from an external fire source.

Recent Developments in the United States

The U.S. market is very different to Europe, with various types of public vehicles, including over-the-road coaches, school buses and transit buses.

Over-The-Road Coaches

These coaches cross state lines and they are under the jurisdiction of the Department of Transportation. Currently, there is no requirement for over-the-road coaches to have anything beyond a portable fire extinguisher. Original equipment manufacturers (OEMs) make the decision to install detection and suppression systems.

After Hurricane Katrina sparked a nationwide catastrophe, insurance premiums rapidly increased. OEMs attempted to negotiate insurance discounts if coaches were fitted with a fire suppression system; however, insurance companies would not agree to discount deals. Ultimately, liability rested with the coaches for losses following a fire. Coaches are privately funded, and OEMs are not regulated by a public authority in relation to fire safety in coaches.

School Buses

There are about .5 million school buses with only a few major manufacturers. Children run practice drills on evacuation and school buses are equipped with big exit doors. The positioning of the engine is critical to detecting fire risk. Bus drivers would be able to spot smoke if the engine is positioned at the front, but if the engine is at the rear of the bus, they would not be able to spot risks as quickly.

Shown here is a Thomas Built Saf-T-Liner C2 Jouley electric school bus. It was photographed westbound on Wacker Drive in Chicago near State Street with the Chicago River adjacent and the Wrigley Building obvious in the background. There apparently are no special fire regulations for electric school buses. THOMAS/DAIMLER.

Currently, there is no requirement for school buses to be fitted with a fire suppression system. The only requirement in Los Angeles County, however, is if school buses use alternative fuel, such as propane or liquefied petroleum gas, they need to be fitted with gas sensors.

This is the first BYD electric coach delivered in the Paris area. Electric coaches share many of the same fire safety concerns as electric transit buses. Substantial work and effort is going into finding way to make them safer. BYD.

Transit Buses

The majority of funding for transit buses comes from the government. Each transit agency is responsible for their own remit, where they decide what fire protection to use and what systems to install.

Around 10 years ago, a rail incident occurred in Washington, D.C. After an investigation, the government found issues with overall safety and gave the transit agency one year to improve its safety protocols. However, the safety protocols were not improved within the year. As a result, now, safety officers are separated from management, and they are solely responsible for ensuring health and safety on transit buses. Currently, many transit authorities, including Washington Metropolitan Area Transit Authority, are supporting the industry through finding new solutions to improve fire risk management.

The bus and coach industry is looking to move rapidly to develop and implement fire risk management, detection and suppression systems for electric vehicles. The industry is evolving in line with the growing worldwide movement to use greener fuels and reduce greenhouse gas emissions.

New Fire Risks and How to Spot Them

Joey Peoples, CEO of Dafo US, and Jay Taylor, regional manager at Dafo's Transit and Motorcoach area, believe the direction of travel for the industry is learning from mistakes and making improvements for the

future. With any new technology, fires are inevitable and there should be more focus on origin and prevention, rather than deliberating who was to blame.

As the industry adapts to make full use of greener fuels, Joey Peoples comments: "All detection and suppression systems need to communicate and work together to determine risk. We need to understand our own systems and understand how one communicates to send warning signals to alert the other to release agent."

Li-ion batteries, commonly used to fuel EVs, are at risk of thermal runaway. The most effective way to address these types of fires is by spot cooling, with early fire cooling systems localizing and mitigating thermal runaway risk.

There are new and specific challenges to overcome and new risk assessments to carry out with the introduction of EVs and HEVs in public transport.

The location is the main difference between vehicles between ICEs (internal combustion engines) and EVs or HEVs. The majority of fire sources in vehicles with ICEs are found in the engine compartment area. However, the potential fire sources can be located in different areas in EVs and HEVs, in which case, more protection zones should be put in place. Additionally, due to the sensitivity of electrical components and the types of fire that could spread in different areas of these vehicles, specific extinguishing agents may need to be used.

You might note that the engine compartment of this Solaris Urbano 12 does not have an engine because it is an electric bus. The experts will tell you that fire risks are substantially different between diesel buses and electric buses. While the engine compartment is usually the top fire hazard on a diesel bus, it is generally the battery that causes the most concern on electric buses.

Risk Management Assessment

The Research Institutes of Sweden (RISE) published a fire risk management assessment, which can be used as guidance and includes the following steps:

1. Hazard identification
2. Risk estimation
3. Risk evaluation
4. Risk reduction.

Failure mode and effective analysis (FMEA) entails identifying hazards and then quantifying risks, so that they can be ranked according to their priority.

After the risks have been quantified, they can be listed in order of priority to provide a holistic view of the risk map. A risk map isolates risks that are deemed to be acceptable from those which need to be addressed.

Finally, an action plan for the identified fire risks can be developed with appropriate risk reduction measures, including:

1) Risk elimination or minimization by design
2) Active and passive fire protection systems
3) Improved cleaning and maintenance procedures
4) Improved quality and training procedures.

As soon as hazards are identified, priorities naturally emerge as to which risks need to be mitigated first. Consequently, the actions that follow this ensure that the automotive industry – including its many and varied users – is made safer.

To find out more about choosing a unique fire protection solution for your electric bus or coach, visit Dafo Vehicle Fire Protection. ❑

BYD recently showed off a new design of 12-meter (39-foot) electric buses at the recent IAA show in Hanover, Germany in September of 2022. They also announced their safer Blade Battery. BYD has electric buses running in numerous countries and cities. BYD.

From the

December, 2022

Issue of

National Bus Trader

9698 W. Judson Road • Polo, Illinois 61064

Ph: (815) 946-2341

Fx: (815) 946-2347

www.busmag.com