

Environment friendly bus fire protection system comprising of water mist system for occupant compartment and condensed aerosol system for engine compartment

Centre for Fire Explosive and Environment Safety (CFEES) was tasked for providing a solution to fire incidents in passenger buses, as a spin -off of technologies developed for defence applications. The urgency to address this concern was felt as the number of such buses on the road have increased significantly and expected to grow further.

Accordingly, CFEES developed an active fire protective system for passenger buses and subsequently worked together with relevant stakeholders in the country to develop necessary provisions in the related Automotive industry Standard (AIS). The collective efforts led to 2021 amendment of AIS-15:2016 to include fire protection system for occupant compartment addressing life safety of occupants. The details of the system developed are as follow:

Fire Protective System (FPS) for occupant compartment: The FPS provides a fine water mist for protection of bus occupants from heat and smoke. The system has been designed based on fire risk assessment of the standard bus and linked to fire alarm system. The system in the passenger compartment includes a network of tubing with suitable number of atomizers linked to a water tank of appropriate capacity, a pressurized nitrogen cylinder. The solution developed by CFEES for occupant compartment reduces the risk to life and property to a significant level and give active protection measure for its implementation. The developed system and the design criteria meets the requirements of 2021 amendment of AIS-135.

Fire Detection and Suppression System (FDSS) for Engine compartment: An Alternative technology has been developed as a very efficient method for fire suppression in engine compartment. The indigenously developed condensed aerosol for extinguishing system (CAFES) consists of system cartridge, aerosol generator, igniter and cooling tablets, housed in suitable casing. CAFES is non-toxic, non-pressurized, no piping cost effective and environmentally safe (based on global warming potential, ozone depletion potential and atmospheric lifetime). The fire suppression was achieved well within the timelines AIS 135:2016.

When fire is detected, the actuation signal is sent to igniter which then activates the aerosol forming composite to produce aerosols with hot gases. The hot gases are cooled by cooling pallets inside the housing and the combustion products (aerosols and gases) come out to flood the area thereby extinguishing the fire. A patent was filed in 2018 on aerosol chemical composition. CAFES system of capacity 50g to 200g has been developed for this purpose.

Test & Evaluation: Prototypes for the system was developed and installed in a 52 seater derelict bus. The fire alarm system comprises of conventional smoke detectors wired to a control panel installed near the driver seat with the provision of an audio visual alarm in case of fire. Several experiments were conducted for test and different

fire scenarios and the results were compared with the results of modeling and simulation.

To understand the fire behavior and the impact of water mist system for externally originated fires, simulation studies were also carried out. The studies include type fire, and fuel tank fire and it was confirmed that the installed system is effective in thermal management of the occupant compartment contributing in life safety.

Similarly CAFES (2 units of capacity of 200g active compound each) was installed at engine compartment of derelict passenger bus and successfully evaluated for fire extinguishing.

Based on studies at CFEES, know how on water mist based system for fire protection in passenger compartment and condensed aerosol system customized for engine compartment of passenger buses are available. The developed subsystems are integrated through a single control panel to meet the requirements of 2021 amendments in AIS-135.

The complete technology package is available for transfer to the interested industry for commercialization.