

FIRE HAZARDS OF LITHIUM ION BATTERIES

A series of tests were conducted to determine the flammability characteristics of type 18650 rechargeable lithium-ion batteries, both individually and as packaged for bulk shipment onboard cargo and passenger aircraft. The tests were designed to determine the conditions necessary for battery ignition, the characteristics of the battery fire, the effect of state of charge, the potential hazard to the aircraft as a result of the fire, and the effectiveness of the standard Halon 1301 fire suppression systems in extinguishing the fire. The work was precipitated by several serious fires on cargo pallets loaded with lithium batteries.



It was determined that a relatively small fire source is sufficient to heat the lithium-ion battery above the temperature required to activate the pressure release mechanism in the battery. This causes the battery to forcefully vent its highly flammable and easily ignitable electrolyte through the relief ports near the positive terminal. Halon 1301, the fire suppression agent installed in transport category aircraft, is effective in suppressing the electrolyte fire and easily extinguishes any fire at both the 5% knock down concentration as well as the 3% suppression concentration. The release of the electrolyte caused by heating a lithium-ion battery produces a pressure pulse that can raise the air pressure within a cargo compartment. Since cargo compartments are only designed to withstand approximately a 1-psi pressure differential, a fire involving a bulk-packed lithium-ion shipment may compromise the integrity of the compartment and cause the halon to leak out of the compartment, reducing its effectiveness. However, it was also shown that a cargo fire involving lithium-ion batteries does not present any unusual stresses on the cargo liner material.

The test findings are contained in FAA report DOT/FAA/AR-06/38, "Flammability Assessment of Bulk-Packed, Rechargeable Lithium Ion Cells in Transport Category Aircraft", published in September 2006.

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