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IFALPA

POSITION PAPER

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Energy Content of Lithium Batteries in Air Cargo

BACKGROUND

ICAO adopted a provision to limit the State of Charge (SOC) of bulk Lithium-Ion Batteries (UN 3480) and Lithium-Ion Batteries packed with equipment (UN 3481) shipped as cargo on aircraft to 30%. Research by Underwriters Laboratories[1] and the FAA[2] [3] as well as other unpublished data indicate that failures involving current models of lithium-ion batteries at SOC below 30% are unlikely to result in thermal runaway, and if there is thermal runaway, propagation from one cell to another is unlikely.

Flammable gas production is also greatly reduced for tested batteries with reduced SOC. Lithium-ion batteries transported at less than 30% SOC are also less likely to aggravate a fire in case of exposure to an external flame source.

Lithium-Ion Batteries packed in equipment (UN3481) can be carried as cargo on both passenger and cargo aircraft and have no SOC limitation when offered for air transport, although the ICAO Technical Instructions recommend that they be shipped at or below the 30% SOC. When the 30% SOC was implemented for bulk lithium-ion batteries, it was assumed that when batteries are packed in equipment, the equipment would provide an adequate level of protection against the hazards of thermal runaway. Therefore, the SOC requirement was not extended to batteries packed in equipment.

Since the energy density of lithium batteries is increasing and the size of components in electronic devices is shrinking, IFALPA believes that the protection afforded by equipment in the event of thermal runaway is not always adequate to protect an aircraft from an onboard thermal runaway in batteries packed in equipment.

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[1] *Jeeravajan, J. Joshi, T. 2021. Battery Packaging Configuration SAE-G27 Tests. Underwriters Laboratories Electrochemical Safety Research Institute.* *https://www.icao.int/safety/DangerousGoods/DGP28/DGP.28.IP.009.4.en.pdf*

[2] *Keslar, D. 2022. An Analysis of State of Charge in Lithium-ion Batteries. US Departments of Transportation. William J. Hughes Technical Center. FAA. https://fire.tc.faa.gov/pdf/tctn22-27.pdf*

[3] *Maloney, T. 2022. Evaluation of Lithium Battery Thermal Runaway Propagation. U.S. Department of transportation. William J. Hughes Technical Center. FAA. https://fire.tc.faa.gov/pdf/tctn21-54.pdf*

There have been numerous incidents of lithium batteries in equipment starting or contributing to fires in sort facilities and in cargo containers on airport ramps either waiting to be loaded onto aircraft or immediately after unloading from aircraft. Some of these incidents have been documented in a database[4] maintained by the FAA in the USA. According to the referenced data, it is unlikely that these incidents would have occurred had the batteries in these shipments been charged to less than 30% SOC.

POSITION

The current 30% SOC requirement should be extended to Lithium-Ion Batteries packed in equipment (UN3481) when offered for air transport. Referenced data indicates this would result in a significant reduction in the risk of uncontrolled fire events involving Lithium batteries packed in equipment in air cargo.

Whilst equipment might afford protection from thermal runaway hazards in some cases, it does not generally provide a sufficient level of protection, and additional mitigation measures should be utilized. Air safety cannot be based on mere assumption that the additional fire resistance provided by equipment is adequate to prevent propagation and in-flight fires.

[4] *https://www.faa.gov/hazmat/resources/lithium_batteries/incidents*