

(AMD-43A)  
(04/10)



# Interagency Aviation ACCIDENT PREVENTION BULLETIN



No. IA APB 12-02

Date: June 6, 2012

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**Subject: Lithium Batteries**

**Area of Concern: Thermal runaway**

**Distribution: All Aviation Activities**

**Discussion:** Lithium batteries fall under hazardous materials regulations (49 CFR 171) due to their potential to overheat and ignite in certain conditions. Additionally, it can be very difficult to extinguish after it has ignited. Department Of Transportation (DOT) rules for lithium batteries are risk based in that it recognizes that the amount of stored energy is the major component of risk of a fire. The amount of stored energy is related to the number of cells in the battery and the total amount of lithium present. In general, the risks posed by lithium batteries are a function of battery size (the amount of lithium content and corresponding energy density) and the likelihood of short-circuiting or rupture.



By comparison to standard alkaline batteries, most lithium-ion batteries manufactured today contain a flammable electrolyte with a very high energy density. A lithium battery is susceptible to thermal runaway, a destructive chain reaction resulting from self-heating and the release of its stored energy.

Like other products that contain hazardous materials, lithium batteries can be transported safely provided that the appropriate precautions are incorporated in to the design, packaging, handling, and emergency response.

DOI and USFS have been granted a waiver by DOT to carry hazardous material that states that "All aircraft and personnel operating under the terms of this special permit (DOT-SP 9198) must be in compliance with the requirements of the DOI/USDA-Forest Service January 2005 "Interagency Aviation Transport of Hazardous Materials Handbook/Guide"....." (see IA Tech Bulletin 2012-01(revised) Hazmat Special Permit DOT-SP-9198 dated December 27, 2011).

The Interagency Aviation Transport of Hazardous Materials Handbook/Guide states: "A. All batteries, **regardless of type**, must be protected from short circuits by nonconductive terminal caps, tape, covers, or containers." Although the handbook does not specifically mention lithium ion batteries by name, the term "All batteries" provides for their inclusion.

Here are some tips for battery safety:

- Clearly identify every battery you use as to type. If it contains lithium, make certain it is clearly marked.
- Pack spare batteries in baggage that is easily accessible in case an incident does happen.
- Keep spare batteries in the original retail packaging, to prevent unintentional activation or short-circuiting.
- If original packaging is not available, effectively insulate battery terminals by placing tape over the contacts. Place each battery in its own protective case, plastic bag, or package. Do not permit a loose battery to come in contact with metal objects, such as coins, keys, or jewelry.
- Only charge batteries which you are sure are rechargeable! Non-rechargeable batteries are not designed for recharging, and become hazards if they are placed in a battery charger. NEVER attempt to recharge a battery unless you know it is rechargeable. If you have already charged a non-rechargeable battery, do NOT bring it on board an aircraft.
- Special consideration must be given to the type of electrical power provided for the recharging of lithium ion batteries. Lithium ion batteries pose a safety hazard if overcharged or excessively discharged. Operators should have lithium ion battery charging procedures that are in accordance with the battery manufacturer's charging instructions to prevent lithium ion battery thermal hazards.
- Take steps to prevent crushing, puncturing, or putting a high degree of pressure on the battery, as this can cause an internal short-circuit, resulting in overheating.
- If a battery starts to overheat, water is effective in stopping the propagation of thermal runaway and is recommended in controlling lithium-ion cell fires in installed equipment. Halon 1211 will extinguish the open flames from a lithium-ion or lithium-ion polymer cell fire and prevent the spread of fire to other ordinary combustibles but will not prevent flare-up as additional cells go into thermal runaway due to the dispersion of the agent.

Recommended quantity limitations by the FAA are 5kg equivalent lithium content (ELC) for passenger aircraft and 35 kg ELC for cargo aircraft (49 CFR 172.101 Hazardous Materials Table). For quantities greater than these, ensure a proper risk assessment has been approved by the appropriate level of supervision.

**WHEN IN DOUBT, LEAVE IT OUT!!!**

For more information on lithium batteries, go to: <http://safetravel.dot.gov>

References:

1. DOT/FAA/AR-06/38, Flammability Assessment of Bulk-Packed, Rechargeable Lithium-Ion Cells in Transport Category Aircraft
2. DOT/FAA/AR-10/31, Fire Protection for the Shipment of Lithium Batteries in Aircraft Cargo Compartments
3. 49 CFR Part 171, 172.101, 172.188-190

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