



# International Aircraft System Fire Protection Forum (IASFPF) – Batteries Activities

Al Carlo | Boeing Payloads Pressurized Compartment Fire Marshal

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# IASFPWG – Battery Activities

## Agenda

- 3 Categories
  - Portable Electronic Devices used by Passengers and Crew
  - Installed in airplane equipment
  - Batteries as Cargo

# IASFPWG – Batteries Activities

## Situation

- Portable Electronic Devices used by Passengers and Crew
  - Supporting UL activities to develop a standard for Fire Containment Bags for use on commercial transport airplanes
  - Regulations limit spare batteries to carry-on only, none in checked bags, limit size of batteries in carry-on
  - Boeing completed testing on Fire Containment Concepts bags using both RLB and NRLB. Passed using sacrificial liquid bags to limit cell to cell propagation.
  - FAA activity to develop improved video training material for crew

# IASFPWG – Batteries Activities

## Situation

- Installed in airplane equipment
  - Lithium Batteries
    - Special Conditions (67) and CRIs.
    - Regulations, guidance, MOCs and test methods are in the process of being standardized, harmonized and organized to address the complete set of requirements needed for qualification and certification (Cell, Battery, Device and Installation Levels)
  - Alkaline Batteries
    - As of early 2018, now treated as electrical equipment and must be shown compliant to 25.1353.

# IASFPWG – Batteries Activities

## Situation

### ➤ FAA Special Conditions for Non-Rechargeable Lithium Battery Installations

In lieu of § 25.1353(b)(1) through (b)(4) at Amendment 25–113, each non-rechargeable lithium battery installation must:

1. **Maintain safe cell temperatures and pressures** under all foreseeable operating conditions to prevent fire and explosion.
2. Prevent the occurrence of **self sustaining, uncontrollable increases in temperature or pressure**.
3. **Not emit explosive or toxic gases**, either in normal operation or as a result of its failure, that may accumulate in hazardous quantities within the airplane.
4. Meet the requirements of **§ 25.863**.
5. Not damage surrounding structure or adjacent systems, equipment, or electrical wiring from **corrosive fluids or gases** that may escape in such a way as to cause a major or more-severe failure condition.
6. Have provisions to prevent any hazardous effect on airplane structure or systems caused by the **maximum amount of heat** it can generate due to any failure of it or its individual cells.
7. Have a failure sensing and warning system to **alert the flight crew** if its failure affects safe operation of the airplane.
8. Have a means for the flight crew or maintenance personnel to **determine the battery charge state** if the battery's function is required for safe operation of the airplane.

Note 1: A battery system consists of the battery and any protective, monitoring, and alerting circuitry or hardware inside or outside of the battery. It also includes vents (where necessary) and packaging. For the purpose of these special conditions, a “battery” and “battery system” are referred to as a battery.

# IASFPWG – Batteries Activities

EASA CERTIFICATION REVIEW ITEM (CRI): F-GEN-11, Issue 2, October 11, 2016; Non-rechargeable Lithium Batteries Installations; Applicable to: 717,727,737, 737MAX, 747, 757,767,777, 787, DC-9/MD-80, MD-11

Same 8 Special Conditions as FAA but the following Notes are added.

Note 2: These special conditions apply to all non-rechargeable lithium battery installations in lieu of 25.1353(c)(1) through (c)(4). Section 25.1353(c)(1) through (c)(4) will remain in effect for other battery installations.

Note 3: For Very Small Non-rechargeable Lithium Batteries (equal or less than 2 Watt-hour of energy), an acceptable MoC with this Special Conditions is showing these batteries compliant with Underwriters Laboratories (UL) 1642 or UL 2054

Note 4: For the purpose of SCs 7 and 8, “safe operation of the airplane” is defined as continued safe flight and landing following failures or other non-normal conditions. The following are examples of devices with batteries that are not required for continued safe flight and landing of the airplane: emergency locator transmitters, underwater locator beacons, seat belt air bag initiators and flashlights. A backup flight instrument with a non-rechargeable lithium battery is an example that would be required for safe operation of the airplane.

Due to missing a more appropriate standard, RTCA DO 227 with a Risk assessment at A/C level is an acceptable MoC to the SC contained in this CRI.

# IASFPWG – Batteries Activities

- Installed in airplane equipment
  - Lithium Batteries
    - Working with suppliers to test current equipment, revised equipment, new equipment and equipment with added containment provisions against DO-227A and DO-311A. Portable ELT, Fixed ELT, ULB, LF-ULD, Seat Inflatable restraints,
  - Alkaline Batteries
    - Working with suppliers to complete failure testing. Flashlights, Megaphones
    - Working with Suppliers to encourage use of cells per IEC 60086-5 and/or ANSI C18.1M

# IASFPWG – Batteries Activities

## Battery Documents

- Advisory Circulars - incorporates Policy Statements/MOC Issue Papers into ACs
  - RLB – AC 20-184, 10/15/15
    - AC 20-184A Draft, 10/12/18 with comments submitted 11/17/18
      - Disagreed with not allowing Appendix C of DO-311A as an acceptable alternate method for battery thermal runaway containment tests (section 2.4.5.5)
      - Proposed to delete “Button/Coin” restriction for installations with less than 2Wh to align with DO-311A.
  - NRLB – AC 20-192, Draft 10/12/18 with comments submitted 11/17/18
    - Proposed to delete “Button/Coin” restriction for installations with less than 2Wh to align with DO-227A.
    - Proposed to add Means of Compliance similar to Part 23 for battery installations less than 5 Wh. “Meeting the minimum performance standard for TSO C142b-7 is an acceptable means of showing compliance for cells or batteries less than 5 Wh.”
- TSOs Updated to reference revised documents
  - Batteries
    - RLB – TSO C-179b, 3/23/18
    - NRLB – TSO C-142b, 3/26/18
  - Equipment
    - 406 MHz ELT – TSO C-126b, 11/26/12
    - Others?



# IASFPWG – Batteries Activities

## Battery Documents

- RTCA documents
  - RLB – DO-311A, December 19, 2017
  - NRLB – DO-227A, September 21, 2017
  
- Regulations
  - FAR/CS 25.1353, Amdt. 25-123, Eff. 12/10/07
  - NPRM? Plan to incorporate Special Conditions into Regulations?
  
- Detailed Test Procedures in a Handbook like Fire Test Handbook?

# IASFPWG – Batteries Activities

## Situation

- Batteries as Cargo
  - SAE G-27 to develop a performance based test standard for packages containing lithium cells or batteries. Goal is to contain a single cell failure internal to the package. Does not address batteries within equipment.

