SAE G27 Committee Update

Presented to International Aircraft Systems Fire Protection Forum

April 17, 2024

Doug Ferguson – Boeing (G27 co-chair)

Brian Johnson – Boeing (G27 Secretary)

SAE G27 Committee Update

- **SAE G-27 Committee formed in March, 2016 at ICAO ANC request to create a performance-based package standard (AS6413) for the safe transport of lithium batteries as cargo by air.**

- **Co-chaired by Doug Ferguson (Boeing) and Claude Chanson (Recharge)**

  - ~ 200 individuals on G-27 Committee
    - Includes international organizations, airframe manufacturers, regulators, cell manufacturers, battery manufacturers, battery users, operators, package manufacturers, test facilities
  - ~ 40 Voting members,
  - ~ 75 individuals consistently, actively engaged
    - Monthly Webex teleconference calls
    - Average of 3 in-person multi-day meetings per year
    - Next in-person meeting will be in Montreal in July

SAE G27 Committee Update - AS6413 Draft

- **This standard provides a test method to demonstrate and document the control of the potential hazards from Lithium metal batteries (UN 3090) and Lithium-ion batteries (UN 3480) when transported as cargo on aircraft.**
- **It addresses the need to control the hazards which might arise from a failure of an individual cell by containing the hazards within the package.**
- **Controlling the consequences of a failure within the package is intended to prevent uncontrolled fire and pressure pulses that may compromise current fire suppression systems within the cargo compartment.**
- **The intent of this test is to severely abuse a single cell such that it is most likely to enter thermal runaway with the presumption that a single cell may enter thermal runaway during transport.**

SAE G27 Update - AS6413 Draft

- Intention is to address the safety of the cell/battery and packaging material (box, etc) together. Can allow for less protection from the package if the cell is inherently safer.

1. Initiate a thermal runaway (TR) in a cell within the package by heating at 5 to 20 C per minute.
2. Remove heater power when cell has entered TR or reached 375 C.
3. If no confirmation of initiation cell TR after cell reaches 375 C, then remove heater power and monitor pass/fail criteria for 5 hours.
4. If no TR, verify cell TR would have happened if at 100% State of Charge (SOC).
5. If still no TR, note in report and on test summary sheet.

SAE G27 Update - AS6413 Draft

- **Verification of “non-hazardous flame” and “non-hazardous particle” achieved visually or with witness panels**
- **Surface of package shall not be sufficient to ignite adjacent materials.**
- **Non-hazardous quantity of flammable vapor released outside package**

SAE G27 Update - AS6413 Draft

G27 Background Test
From FAA Systems Presentation
"G27 Packaging Tests", Tom Maloney, May 2017

SAE G27 Update - AS6413 Draft

- **Baseline test method has been validated in multiple labs with small (18650) cylindrical lithium ion cells.**
- **Multiple labs conducting a validation test series from Oct 2023 through April 2024 for reduced cell quantity in package**
  - Repeatability across labs for low SOC conditions providing consistent “pass”. Initial validation test SOC levels did not result in any “fail” conditions. Increase of SOC for test article cells to ~70% resulted in a “fail”. Some labs will conduct additional testing at similar “high” SOC to validate consistent “fail”.
- **Some lab data for additional configurations, such as pouch cells, fewer cells in package than expected for shipment, surrogate cells, larger cells.**
- **Many additional “variations” or alternatives still require validation, including cells in batteries.**
  - Pouch and prismatic types
  - Lithium metal
  - Benign @SOC
  - Oversize package
  - Generic package
  - External fire slash sheets

SAE G27 Update - PLANS

1. Incorporate discussion from March meeting to release “narrow scope” standard only applicable to small cylindrical lithium-ion cells.
    - Not expected to be incorporated into regulations until later revisions. May eventually be referenced in existing “approval process”
    - Facilitate discussions outside the G27 committee between operators, shippers, test labs, and authorities
        - How is standard expected to be incorporated into regulations?
        - How will audit/oversight of entities be accomplished?
    - Use the released standard to conduct a true “round-robin” review of the ability of the test standard to provide consistent results from multiple labs unfamiliar with the standard
2. Incorporate responses to latest ballot comments and release Aerospace Information Report (AIR) with appropriate intended use, rationales for various parameters
3. The AIR and AS will be released at the same time.
4. Establish priorities and timeline for expanding scope of AS6413 including slash sheets

SAE G27 Update - Ballots

Recent

- September 2022 – AIR 6840
- March 2023 – AS6413
- August 2023 – AS6413
- March 2024 – AIR 6840

Upcoming

- ~ April/May – AIR 6840
- ~ April/May – AS6413
- ~ Third or fourth Quarter 2024 – AS6413/1 and AS6413/2