Draft External Fire Packaging Test for the Transport of Lithium Batteries as Cargo on Aircraft

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Draft External Fire Packaging Test

- Objectives
  - To prevent a shipment of lithium cells or batteries from intensifying an otherwise controllable fire within a cargo compartment.
  - To shield a consignment of lithium cells or batteries such that they do not become fuel for an existing fire or become a secondary ignition source i.e. thermal runaway

Cargo Fire Environment

- Class C
  - Exposure to open flames prior to detection and deployment of Halon 1301
  - Exposure to elevated temperatures after Halon 1301 suppression, 400°F, locally higher
- Class E
  - Exposure to open flames prior to decompression
  - Elevated Temperatures
  - Possible reignition on descent

Existing test methods

- Cargo liner certification test
  - 14 CFR Part 25.855, Appendix F, part III
  - Designed to evaluate the flame penetration resistance capabilities of aircraft cargo compartment lining materials.
  - Simulates open flame conditions in a class C cargo compartment prior to Halon 1301 suppression

FAA Cargo Liner Certification Test

- 1700 DegF flame
- Five minute exposure
- Temperature measured 4” above the liner cannot exceed 400 DegF
- No flame penetration

Existing test methods

- Oxygen generator over pack test
  - 49 CFR Part 178
  - Appendix D, Thermal Resistance Test
    - Oven test, three hour exposure to 400°F
    - 400°F is the estimated mean temperature of a cargo compartment during a halon-suppressed fire.
  - Appendix E, Flame Penetration Resistance Test
    - Similar to cargo liner test method

Draft External Fire Test Method

- This test method applies to packages alone (packages in over-packs, FCCs or FRCs not included).
- Open flame exposure
  - The package must meet the same flame penetration resistance standards as required for cargo compartment sidewalls and ceiling panels in transport category aircraft.
  - The package must meet the standards in Part III of Appendix F of 14 Code of Federal Regulations (CFR) Part 25.

Draft External Fire Test Method

- External fire flame exposure
  - An outer packaging's materials must prevent penetration by a flame of 1700°F for 5 minutes, as described in Part III of Appendix F, paragraphs (a)(3) and (f)(5) of 14 CFR Part 25.
- Oven test
  - the package must remain below the temperature at which the lithium-ion cells self-ignite (thermal runaway).

Draft External Fire Test Method

- Oven test
  - Lithium-ion cells typically go into thermal runaway at 450°F and lithium polymer cells reach thermal runaway at 330°F.
  - The interior of the package must remain below 300°F when exposed to an external temperature of at least 400°F for(X) hours.
  - Package must be tested as prepared for transport
    - A substitute thermal mass may be used to simulate the battery or cells.