



**Testing for Characterizing Lithium-Ion Battery Fires
Fire Protection Issues in All Electric Aircraft**

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Fire Containment Standards for Li-Ion Battery Systems Lack Focus on Firewall Integrity

DO-311A – Battery Thermal Runaway Containment criteria:

- a) No release of fragments outside of the battery system
- b) No escape of flames outside of the battery system, except through the designed venting provisions.

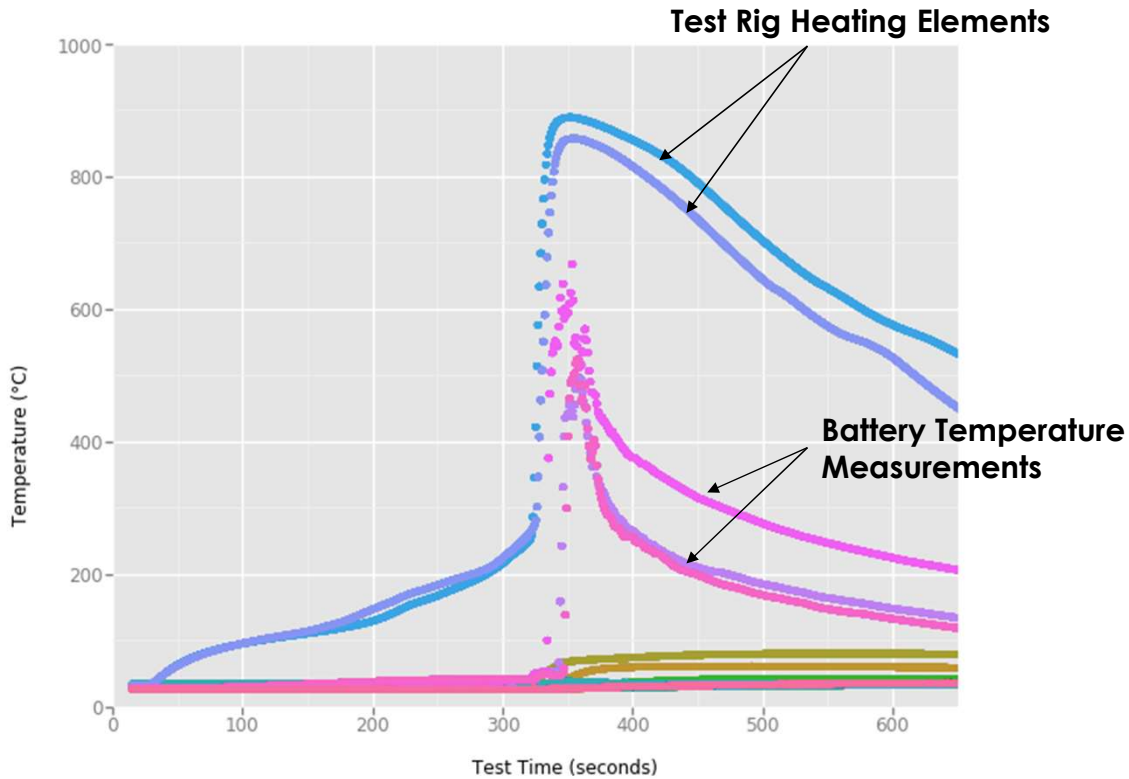
“Battery system” does not include distinct firewall or fire containment enclosure.

DO-311A section 2.4.5.4 “Single Cell Thermal Runaway Containment Test” is a test for containing runaway, not containing resultant battery fire.

Depending on the battery cell location a “contained” thermal runaway cell could result in a fire from which the airframe needs to be protected.

RTCA DO-311A – Minimum Operational Performance Standards for Rechargeable Lithium Batteries and Battery Systems

Thermal Runaway Testing Demonstrates Typical Short Duration Fire Events



Battery Temperature Profiles Indicative of Fire Profile



Short Duration Fire Event

Battery Fires are Recognized as Short Duration

Powerplant standard for firewalls defined in AC 20-135 as 2000F flame for 15 minutes.

SAE J2464 defines fire from battery as “Ignition and sustained combustion of flammable gas or liquid (approximately more than one second).” The subtext is that battery fire duration is typically short although some automotive battery fires have had much longer duration.

Large difference between battery fires and fuel fed powerplant fires demonstrate need for firewall containment standards to be unique for Li-Ion battery system fire protection.

SAE J2464- Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System (RESS) Safety and Abuse Testing

- **Flame intensity and duration should reflect demonstrated battery system thermal runaway fire characteristics.**
- **ASTM committees considering Fire testing standards.**
- **An FAA AC and/or an EASA AMC would provide an authoritative Means of Compliance for battery fire containment standards.**