

# Update of Tests Performed for External Fire Considerations of Battery Packaging

Presented to: Systems Group

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Federal Aviation  
Administration



# Background

- **SAE g-27 is creating a packaging standard to safely ship lithium batteries.**
- **The FAA performed tests to evaluate the use of an external fire materials tests.**
- **The package material would be exposed to an external fire and the backside temperature would have a maximum allowable value in a specific amount of time.**

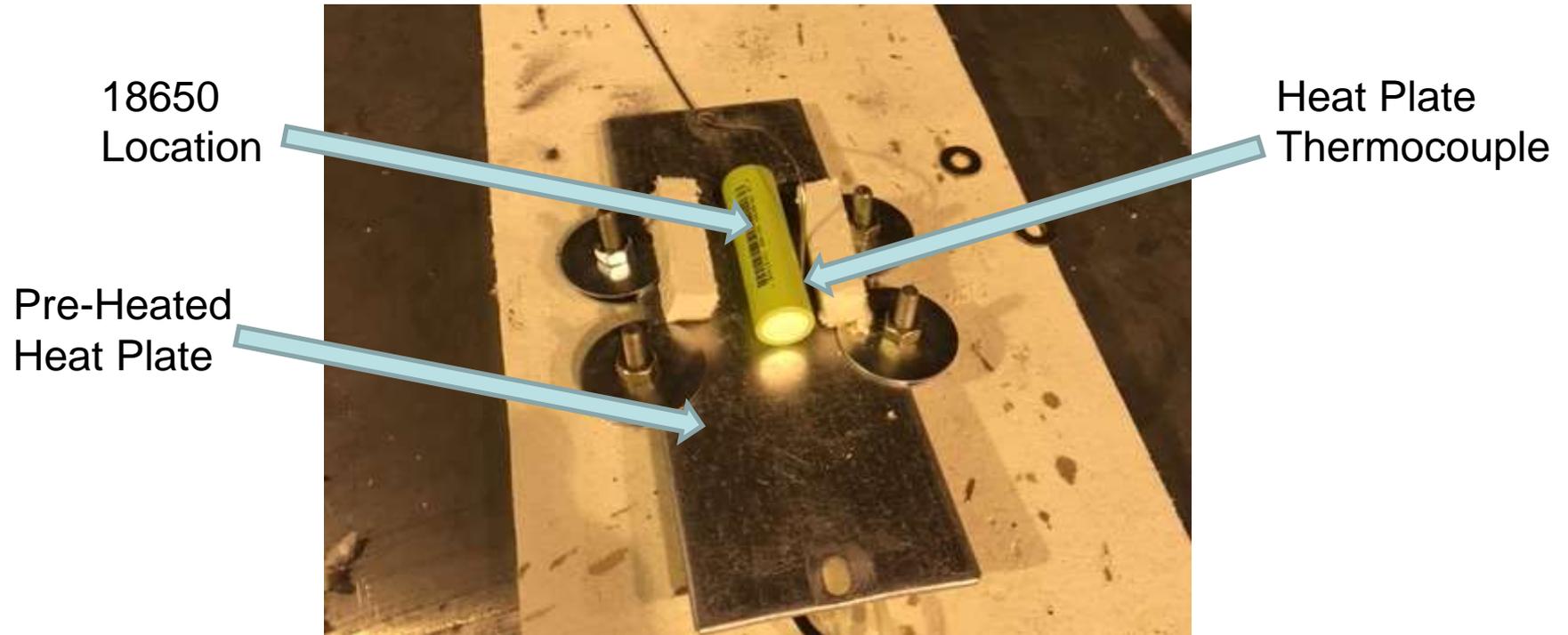


# Oxygen generators vs. Batteries

- **The “Flame Penetration Resistance Test” became a requirement for oxygen generator shipment packages after several incidents including ValuJet flight 592.**
- **Oxygen generators vs. batteries**
  - Both react at about the same temperature
  - Both emit gasses that make up a leg of the fire triangle.
  - Both have high heat of reaction.
  - Both propagate.

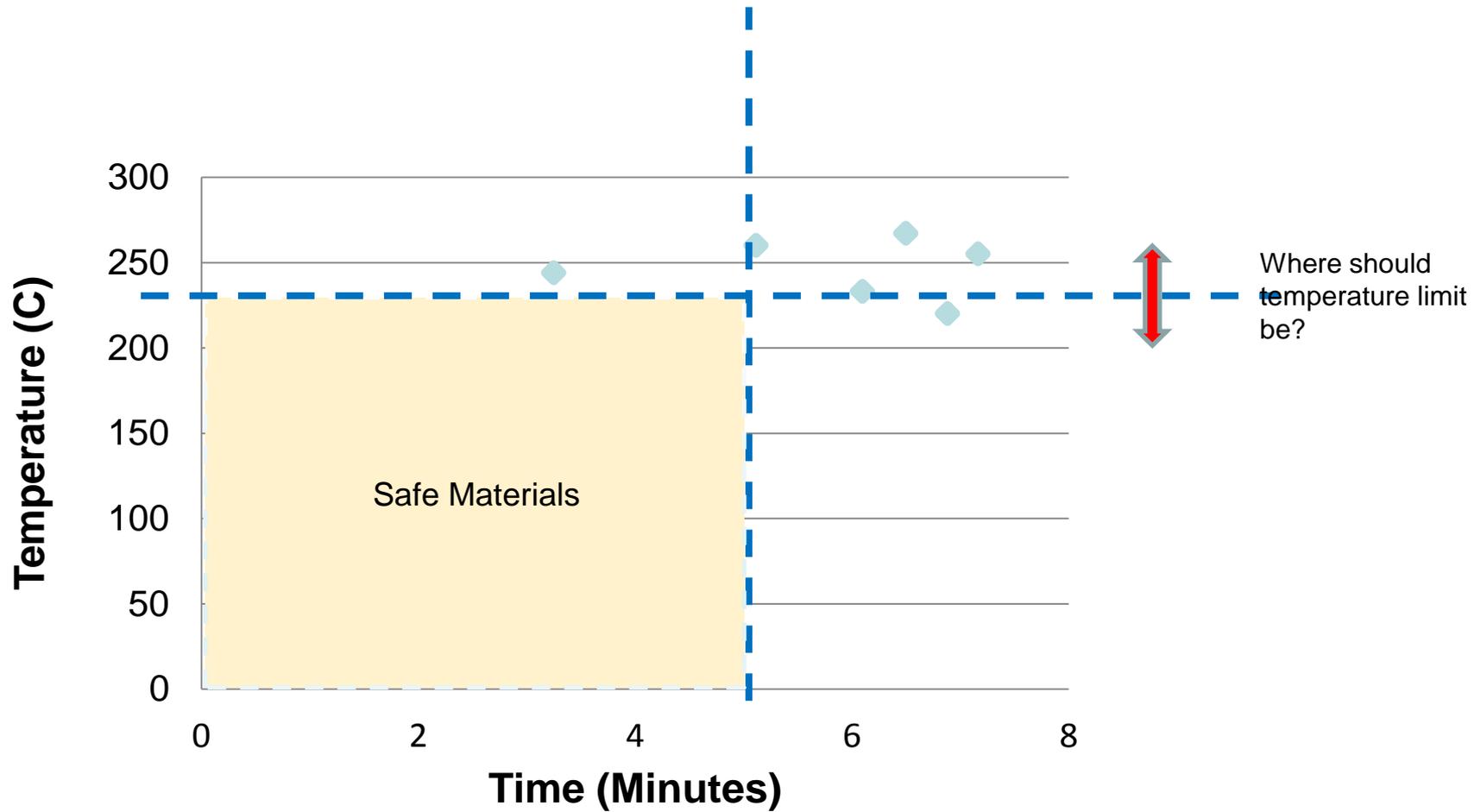


# Test Setup



# Results

Fix at 5 minutes to copy PHMSA "Flame Penetration Resistance Test"



# Discussion

- **Because:**

- Tests were conducted with an 18650 and many cells are smaller and would heat up faster.
- There is inherent variability in battery testing.
- 200C is approximately the thermal runaway temperature for many cells.



200 Celsius is what we recommend for the maximum backside material temperature.



# Summary

- **PHMSA Flame Penetration Resistance Test (49 CFR Part 178 Appendix E)**
  - Temperature **4** inches above material cannot exceed **205C** in 5 minutes
- **Proposed External Flame Material Battery Package Test**
  - Temperature **0** inches above material cannot exceed **200C** in 5 minutes

