AMSAFE BRIDPORT

IATA

Nordisk AVIATION PRODUCTS

James I Moore
Engineering Manager – Cargo

TOWARD A UNIFIED FIRE TEST STANDARD FOR ULDS AND LITHIUM BATTERIES

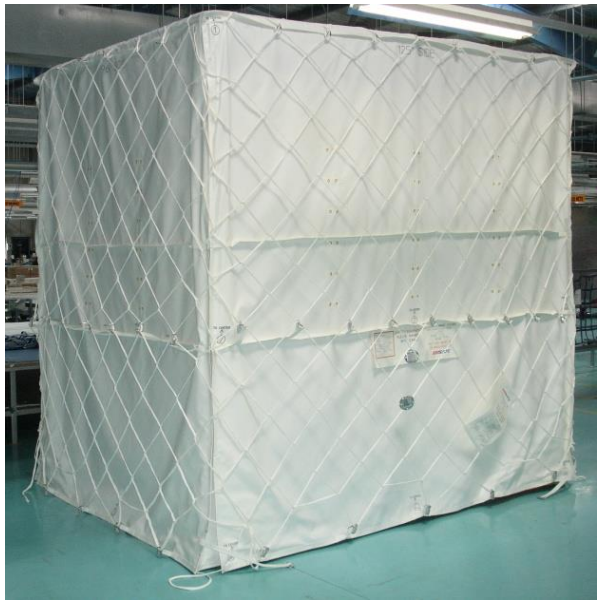
CEC BELGIUM SPET 2025

CONTENTS

- FRC and FCC Usage Cases
- FRC and FCC Performance Standards
- What Does Certified Mean?
- What Will The Li-ion Testing Look Like?
- How Do FRCs & FCCs Fit Into A Safety Approach?
- F Marking Explanation

FRC AND FCC USAGE CASES

- An Fire Resistant Container (FRC) is a type of Unit Load Device (ULD) whose panels and door are made out of a fire resistant material.
- A Fire Containment Cover (FCC) is a fabric cover that fits over a palletised cargo load. Must be used with a C90 certified pallet net.
- Both devices are designed to contain a fire for 6 hours, to allow time to divert the aircraft and apply emergency procedures.
- Designed for use in main deck and lower deck cargo compartments.



- Both are passive systems i.e. they slow or prevent the spread of fire, smoke, and heat without requiring human intervention or activation.
- Solutions are not airtight, they allow smoke to escape to facilitate detection of an on-board fire.
- Secondary effect of reduced oxygen flow helps to supress the fire. This results in incomplete combustion of the load, releasing less energy.

FRC AND FCC PERFORMANCE STANDARDS

- FRCs are certified under **TSO-C90**, the technical standard order for ULDs. This refers to **SAE AS 8992** for details of FRC full scale fire testing.
- Fire Containment Covers (FCCs) are certified under **TSO C203**. This refers to **SAE AS 6453** for details of FCC full scale fire testing.
- The certification standards define minimum performance criteria for FRCs and FCCs.
- Adherence to the standards is independently assessed and certified, including assessment of compliance to the full scale fire testing standards.

WHAT DOES CERTIFIED MEAN?

- Full scale fire testing is done using a class A fire load; cardboard boxes filled with shredded paper.
- No FRC or FCC currently can be certified as containing a lithium ion (li-ion) battery fire, as no standardised test for li-ion battery containment has been agreed to certify against.
- Manufacturers have conducted their own testing to demonstrate li-ion battery fire containment, using various numbers of batteries and different test setups
- Operators have also defined their own performance requirements for qualification against, to try to replicate realistic scenarios for the product that they carry.
- A consistent approach is needed to allow for consistent performance evaluation and comparison.

WHAT DOES CERTIFIED MEAN?

- The experts from the from IATA ULD and dangerous goods boards have been working closely with SAE AGE-2, on behalf of the airline industry, to push for the development of a minimum performance standard for li-ion containment fire testing standards for FRCs and FCCs.

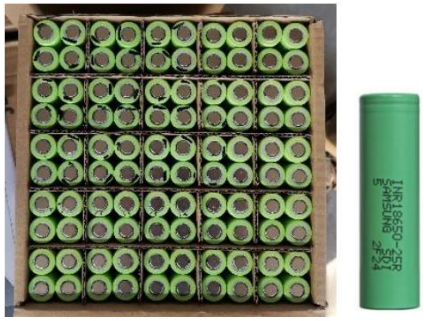
- Li-ion battery shipping, fire testing and ULD certification experts, manufacturers and operators have also been consulted to propose a reasonable, but severe enough, minimum performance standard.

- The strategy is to avoid covering every variable in a worst case scenario, but to present an industry agreed scenario that includes a certain safety margin.

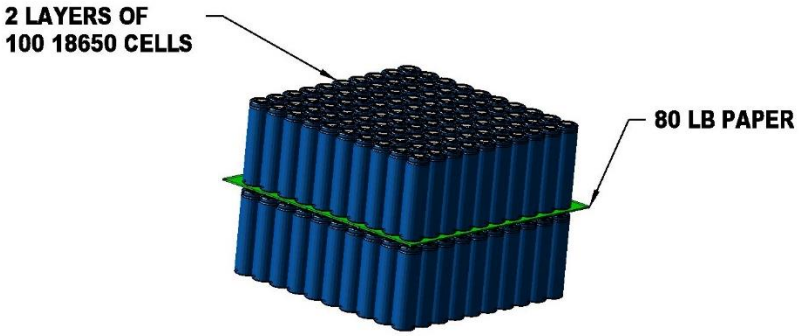
- Both standards are still in development. The FRC standard SAE AS 8992 being closer to completion. Details from the proposed FRC test standard follow on the next few slides.

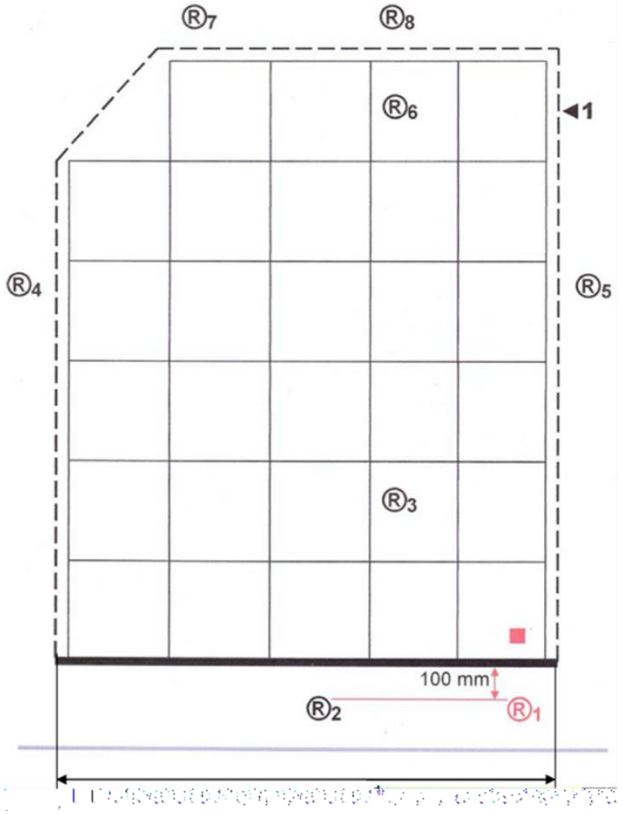
WHAT WILL THE LI-ION TESTING LOOK LIKE?

- Key battery variables;
  - 600 minimum of 18650 cylindrical cells (equivalent energy).
  - Lithium nickel cobalt oxide chemistry.
  - 3350mAh minimum capacity (3450mAh typical).
  - State of charge minimum 60% (equivalent energy).
  - At least 80% of batteries having gone into thermal runaway.



- Key fire load construction variables;
  - Fixed ignition box position.
  - All cells positioned around the ignition box.
  - Each layer of 100 cells separated by 80lb paper.
  - Rest of the fire load remains cardboard boxes filled with shredded paper.
  - ULD contour created through construction of the load.
  - Position of FRC above the floor.





WHAT WILL THE LI-ION TESTING LOOK LIKE?

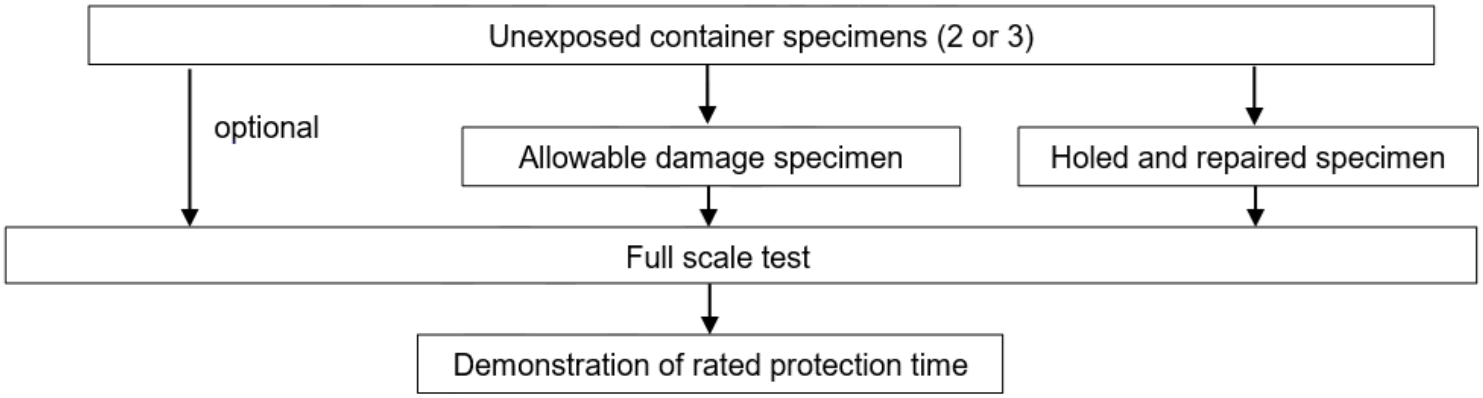
WHAT WILL THE LI-ION TESTING LOOK LIKE?

- Testing pass criteria
  - There shall be no flame penetration (burn-through) at any time.
  - The peak measured temperatures (at 100mm or 4” from the cover) shall at no time exceed 204°C (400°F).
  - Exterior ignition of the test specimen not exceeding 60 seconds is permitted as long as the 204°C (400°F) requirement is not exceeded.
  - Flame penetration is not to be mistaken with off gassing of certain non-metallic materials.

- Testing is stopped after 6 hours, to demonstrate a minimum protection time of 6 hours. No requirement to determine maximum protection time.

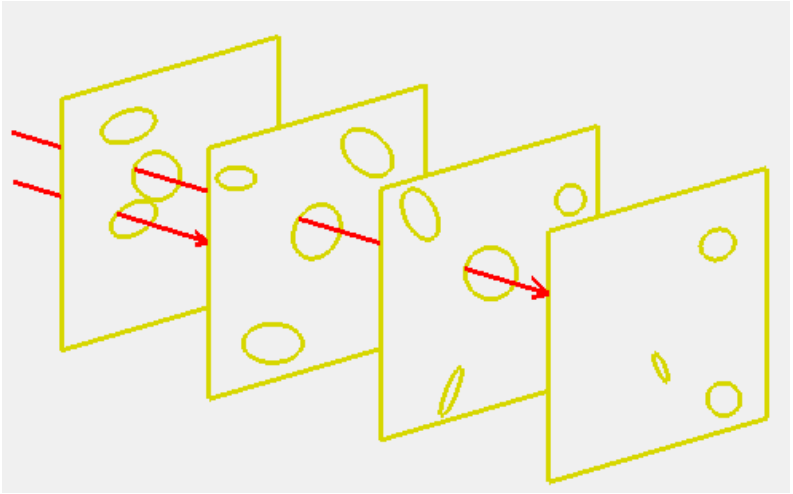
WHAT WILL THE LI-ION TESTING LOOK LIKE?

- Standards require manufacturers to demonstrate the performance of the FRC/FCCs with the maximum allowable damage levels.
- Standards also require definition and substation of repair methods through component and full scale testing.
- FRC and FCC which pass the standardised li-ion battery fire containment test, will be considered to have passed the class A fire containment test by default.
- FRC/FCC exceeding the damage limitations might still be retained in service, but not used as a fire containment system. Dependent on limitations imposed by the manufacturer.



HOW DO FRC/FCC FIT INTO A SAFETY APPROACH

- FRC and FCC form part of a multilayered fire safety strategy to meet the requirements of ICAO Annex 6 Chapter 15 ‘Cargo Compartment Safety’.
- The layers of safety should include considerations like packaging, goods screening, FRC/FCC, cargo hold classification.
- Ensuring operators have knowledge of the importance of FRCs / FCCs, their use and their limitations is crucial when developing policies and procedures to maintain a safe environment.
- FRC/FCC are an additional layer of safety; dangerous goods rules, for example state of charge, must still be followed.
- Fire risks can come from declared or undeclared dangerous goods, FRC/FCC can help to mitigate the risk from both sources.



F MARKING

- The F marking is applied to FRC/FCC that have passed the full scale fire test for class A fire protection.
- Crossed out F marking applied to FRC/FCC that have not met the requirement.
- Ongoing discussions regarding how to indicate an FRC/FCC has passed the new li-ion battery containment test.
- Likely to be F symbol with a number de-noting how many batteries (equivalent energy) were included within the fire load.

CONCLUSION

- FRC and FCCs can form an important part of a multi-layered safety strategy to protect aircraft from li-ion battery fires.
- The current certification standards cover only full scale testing with class A materials; i.e. cardboard and paper.
- Manufacturers and operators have done a variety of testing to demonstrate li-ion battery fire containment. However, the large number of important variables for the testing makes comparison and assessment of performance difficult.
- Test standards are currently being worked on which will establish a clear minimum performance standard and methodology for li-ion fire containment testing throughout industry.