

Section 38.3.3

August 2015 Presentation Meeting

- Change cycling requirements to 25 cycles from 50 cycles
 - Number of 25 cycles aligns with large batteries requirements section 38.3.3
 - Harmonize with IEEE1725 standard CELL test section 5.6.6 “Evaluation of excess lithium plating”

And

- Move cycling requirements from batteries to cells for T1 to T5 Tests
 - Detect cell anomaly (such as Lithium plating, activation of cell internal safety device) prior to the battery testing
 - Allow cells to be cycled at maximum continuous current rates specified by manufacturers. Battery rates may be limited based on safety electrical circuit limits

Section 38.3.3

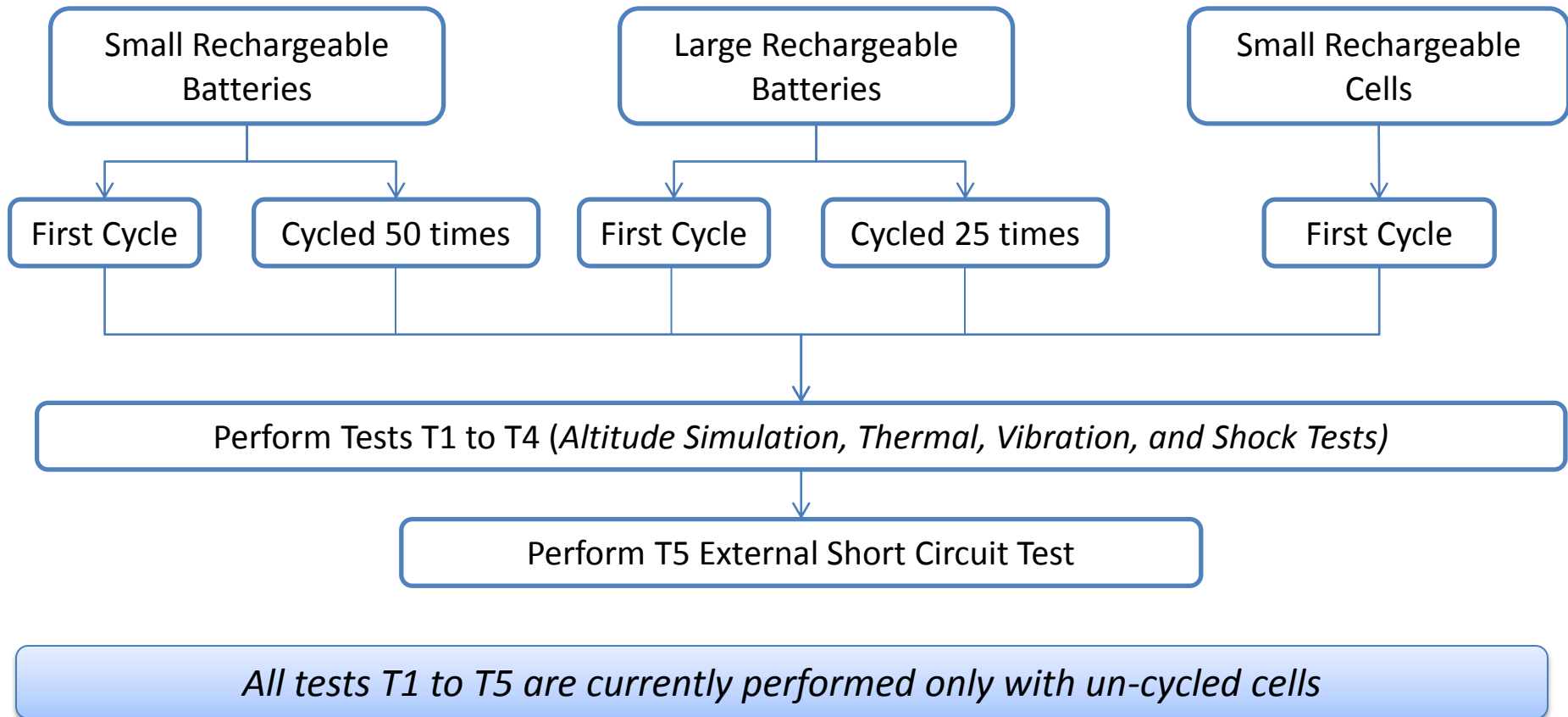
Tests T1 to T5 Flow:

Add Cell Cycling:

- Detect cell anomaly (such as Lithium plating, activation of cell internal safety device) prior to the battery testing
- Harmonize with IEEE1725 standard cell test section 5.6.6 “**Evaluation of Excess Lithium Plating and Short-Circuit Test on Cycled Cells**”
- Allow cells to be cycled at maximum continuous current rates specified by manufacturers. Battery rates may be limited based on safety electrical circuit limits
- Cell cycling does not prolong test cycle time and is no longer than existing test flow (i.e. same time as T8 Forced Discharge)
- Change cycling requirements to 25 cycles from 50 cycles
 - Number of 25 cycles aligns with large batteries requirements section 38.3.3
 - Harmonize with IEEE1725 standard CELL test section 5.6.6 “Evaluation of excess lithium plating”
 - Cells at 25 cycles have more energy than 50 cycles

UN Manual of Test T1 to T5

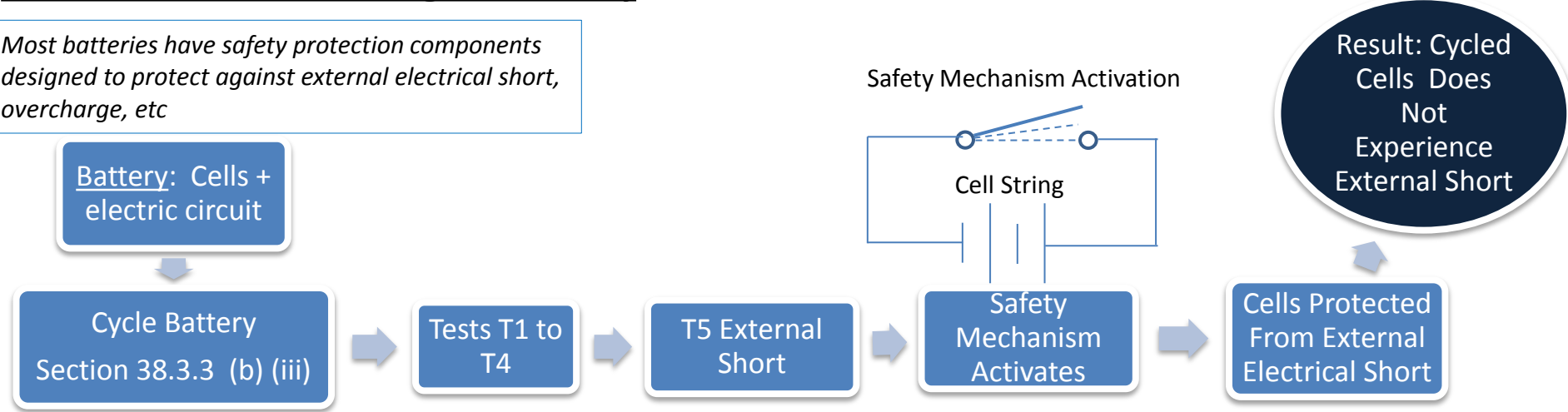
UN Manual of Tests: T1 to T5 Sample Preparation - Today Flow



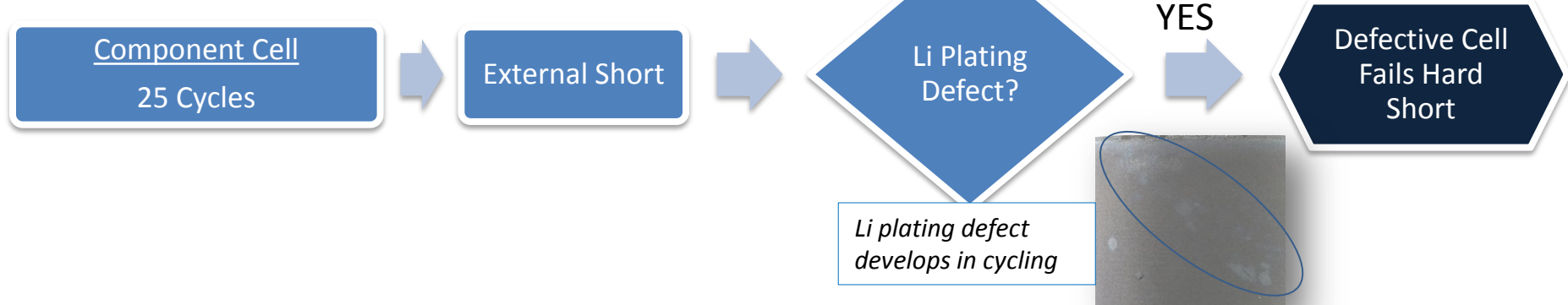
Cycled Cell Component External Short T5 Test

UN Manual of Tests – Rechargeable Battery

Most batteries have safety protection components designed to protect against external electrical short, overcharge, etc



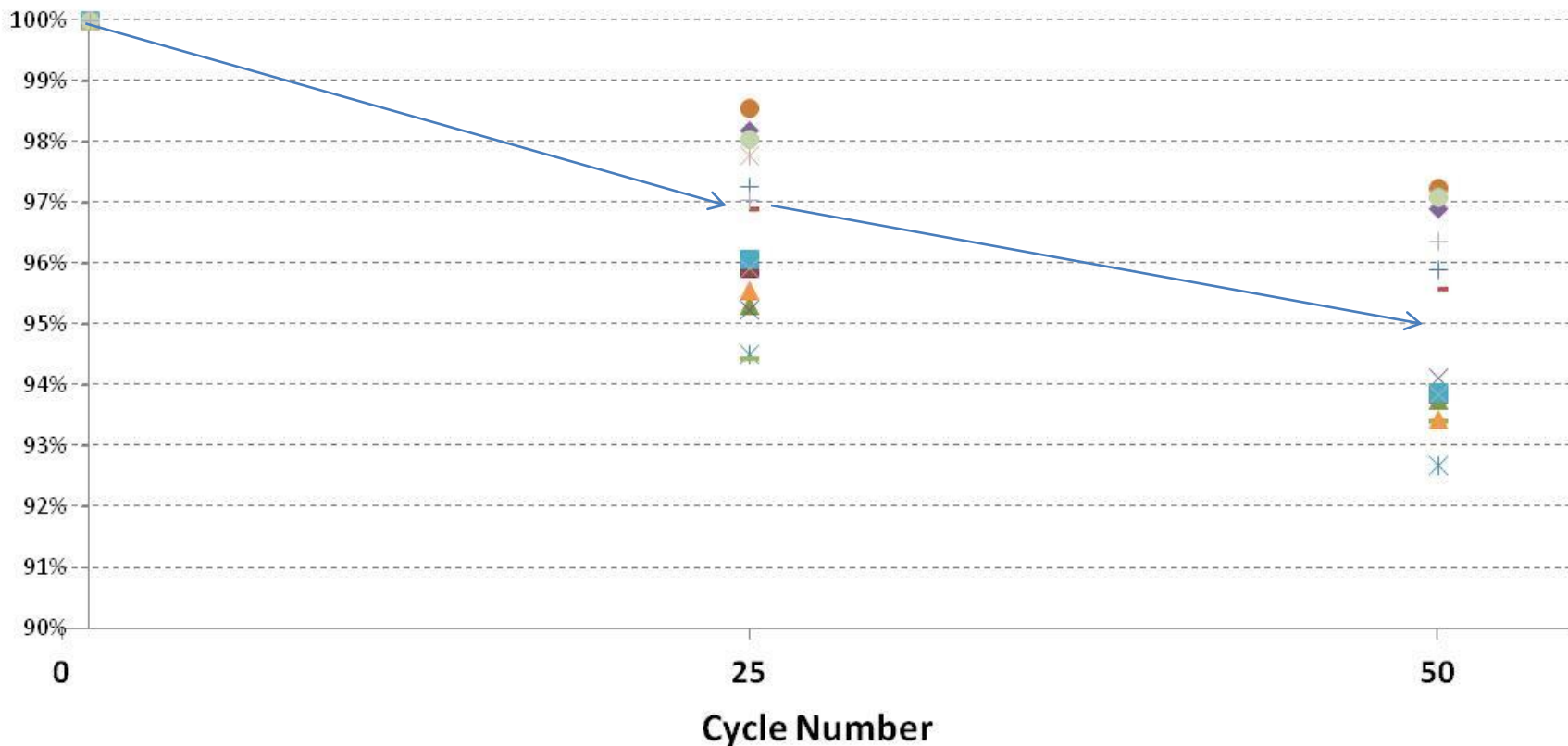
IEEE17025 Standard – Rechargeable Cell



External Short T5 Test: Cycled Battery Results NOT Equivalent to Cycled Cells Results

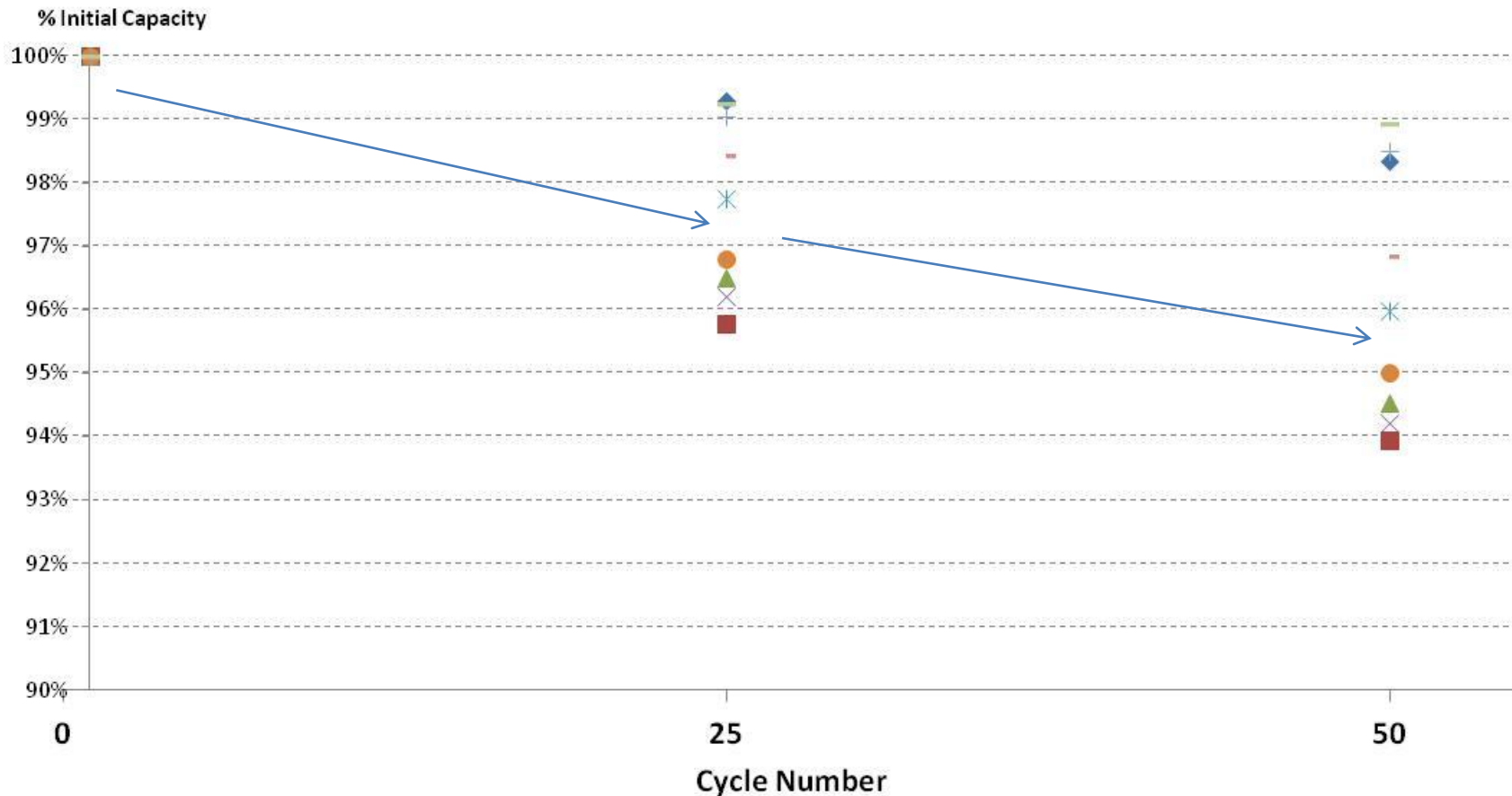
Energy Comparison – Prismatic Cell

% Initial Capacity



Cell Energy Fresh > @ 25 Cycles > @ 50 Cycles

Energy Comparison – Cylindrical Cell

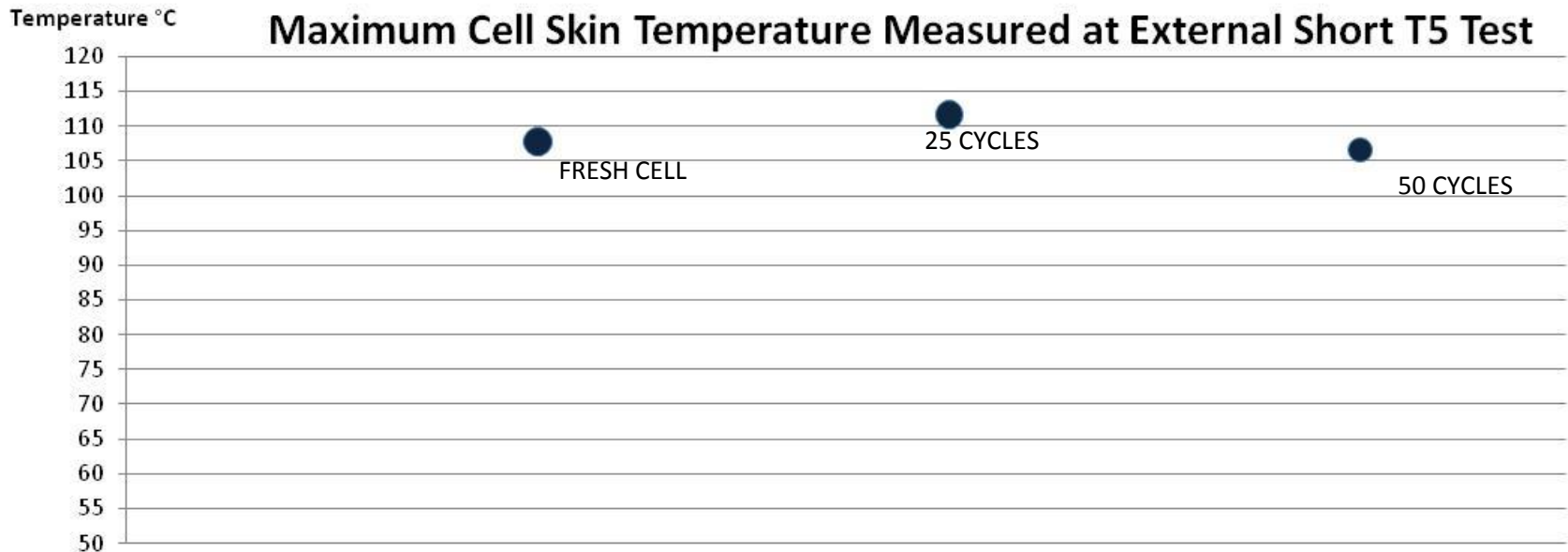


Cell Energy Fresh > @ 25 Cycles > @ 50 Cycles

Cycling Effect on Cell External Short T5

Component Cell External Electrical Short T5 Test Procedure

- Fresh cell
- 25 Cycles - NOT TESTED TODAY
- 50 Cycles - NOT TESTED TODAY



Conclusions:

No significant temperature difference

25 Cycles cell temperature shows slightly higher than fresh and 50 cycles temperature

Conclusion

- Cycling cells for T1 to T5 Tests detects cell anomaly (such as Lithium plating, activation of cell internal safety device) prior to the battery testing
- Detect cell anomaly (such as Lithium plating, activation of cell internal safety device) prior to the battery testing
- Change cycling requirements to 25 cycles from 50 cycles harmonizes with number of cycles in large batteries and IEEE17025 standard “Evaluation of excess lithium plating”
- Cells at 25 cycles have more energy than 50 cycles. The sooner the testing in cycling, the better energy is available at T1 to T5 tests

Section 38.3.3 Proposal for change

(b) When testing rechargeable cells and batteries under tests T.1 to T.5 the following shall be tested in the quantity indicated:

- (i) ~~four ten~~ cells at first cycle, in fully charged states;
- (ii) Add: four cells after 25 cycles ending in fully charged states;
- (iii) four small batteries at first cycle, in fully charged states;
- (iii) four small batteries after ~~50~~ 25 cycles ending in fully charged states;
- (iv) two large batteries at first cycle, in fully charged states; and
- (v) two large batteries after 25 cycles ending in fully charged states

(d) When testing rechargeable batteries or rechargeable single cell batteries under test T.7, the following shall be tested in the quantity indicated:

- (i) four small batteries at first cycle, in fully charged states;
- (ii) ~~four small batteries after 50~~ four small batteries after 25 cycles ending in fully charged states;
- (iii) two large batteries at first cycle, in fully charged states; and
- (iv) two large batteries after 25 cycles ending in fully charged states.

Section 38.3.3 Proposal for change

- (e) When testing primary and rechargeable cells and component cells under test T.8, the following shall be tested in the quantity indicated:
- (i) ten primary cells in fully discharged states;
 - (ii) ten primary component cells in fully discharged states;
 - (iii) ten rechargeable cells, at first cycle in fully discharged states;
 - (iv) ten rechargeable component cells, at first cycle in fully discharged states;
 - (v) ten rechargeable cells after ~~50~~ 25 cycles ending in fully discharged states; and
 - (vi) ten rechargeable component cells after ~~50~~ 25 cycles ending in fully discharged states.