

Subject 1642

August 24, 2018

SUMMARY OF TOPICS

The following changes in requirements to the Standard for Lithium Batteries, UL 1642, are being proposed for preliminary review and comment only:

1. For Preliminary Review Only: Addition of new test requirements for soft-case pouch cells for a Narrow Bar Crush Test or Dent Test instead of the Impact Test.

COMMENTS DUE: SEPTEMBER 14, 2018

This proposal is for review and comment only (no ballot at this time). Please note that comments on a preliminary review document will not receive a response from the proposal author through CSDS. Instead, the proposal author will be asked to review the comments and adjust the proposals and/or supporting rationale as the author determines to be appropriate. The preliminary review process is an informal mechanism that provides authors with the opportunity to refine their proposals before they advance to the next stage in UL's standards development process.

In some cases, the author of the proposals may choose to discontinue them. In this case, the author need not do anything after preliminary review has ended. Normally, the next step in the process is the more formal STP ballot and stakeholder review process. Only comments posted during the STP ballot and stakeholder review process will be provided with a response in CSDS.

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined-out~~.

1. For Preliminary Review Only: Addition of new test requirements for soft-case pouch cells for a Narrow Bar Crush Test or Dent Test instead of the Impact Test.

RATIONALE

Proposal submitted by: Alex Liang, UL LLC

The intention of the Impact Test is introducing an internal short-circuit through the deformation of the cell case. This worked well on hard-case cylindrical and prismatic cells. However, for today's pouch cells, based on our extensive testing experience, this test intention can no longer be well fulfilled. Instead of deformation, due to their thin soft aluminum case, pouch cells in many cases are simply cut into halves, and the resulting rough edges or burrs, create external short-circuit and possibly lead to thermal runaway. To properly introduce an internal short-circuit by means of mechanical abuse, two new tests are being proposed specifically for pouch cells, the Narrow Bar Crush Test, Section 14A, and the Dent Test, Section 14B. Either of these tests can be used to replace the Impact Test, Section 14.

PROPOSAL

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Table 6.1
Number of batteries to be used in each test for primary batteries

Test	Conditioning of batteries		
	Fully charged	One half discharged ^a	Complete discharged
Electrical Tests			
Short-Circuit ^b			
at room temp.	5	5	—
at 55°C (131°F)	5	5	—
Abnormal Charge	5	5	5
Forced-Discharge ^c	5	5	—
Mechanical Tests			
Crush	5	5	—
Impact / <u>Narrow Bar Crush / Dent^d</u>	5	5	—
Shock	5	5	5
Vibration	5	5	5
Environmental Tests			
Heating	5	5	—
Temperature Cycling	5	5	5
Low Pressure (Altitude Simulation)	5	5	5
Fire Exposure Test^{e,d}			
Projectile	5 (10)	—	—

^a Only cells with a liquid cathode, such as thionyl chloride or sulfur dioxide, are conditioned by one-half discharge.

^b For multi cell use, see 10.3.

^c For series use only, see 12.2 for details on samples.

^d For hard-case cylindrical cells and prismatic cells, use the Impact Test, Section 14; for pouch cells use either the Narrow Bar Crush Test, Section 14A or the Dent Test, Section 14B.

^e The projectile test may be waived on those primary cells intended for only technician replacement applications (i.e. liquid cathode types).

Table 6.2
Number of batteries to be used in each test for secondary batteries

Test	Fully charged	Batteries conditioned by charge-discharge cycling
Electrical Tests		
Short-Circuit ^a		
at room temp	5	5
at 55°C (131°F)	5	5
Abnormal Charge	5	5
Forced-Discharge ^b	5	5
Mechanical Tests		
Crush ^{a, d}	5 (10)	5 (10)
Impact / <u>Narrow Bar Crush / Dent^d</u>	5 (10)	5 (10)
Shock	5	5
Vibration	5	5
Environmental Tests		
Heating	5 (10) ^c	5 (10) ^c
Temperature Cycling	5	5
Low Pressure (Altitude Simulation)	5	5
Fire Exposure Test		

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Table 6.2 Continued

Test	Fully charged	Batteries conditioned by charge-discharge cycling
Projectile ^e	5 (10)	–
^a For multicell use, see 10.3. ^b For series use only, see 12.2 for details on samples. ^c For lithium ion cells due to need to test cells conditioned at the operating region boundaries per 6.3 – 6.5. ^d <u>For hard-case cylindrical cells and prismatic cells, use the Impact Test, Section 14; for pouch cells use either the Narrow Bar Crush Test, Section 14A or the Dent Test, Section 14B. Since prismatic cells require two test orientations, 10 prismatic cells will be required.</u> ^e Five more samples may be retested if there is a noncompliance in the first set of five tested.		

14 Impact Test

14.2 A cylindrical, ~~pouch~~ or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8-mm (5/8-in) diameter curved surface lying across the center of the test sample. A prismatic cell is also to be rotated 90° around its longitudinal axis so that both the wide and narrow sides are subjected to the impact. Each sample is to be subjected to only a single impact. Separate samples are to be used for each test.

Exception No. 1: For lithium ion systems, a cylindrical, ~~pouch~~ or prismatic cell is to be impacted with its longitudinal axis parallel to the flat surface and perpendicular to the longitudinal axis of the 15.8-mm (5/8-in) diameter curved surface lying across the center of the test sample. Each sample is to be subjected to only a single impact. Test only the wide side of ~~pouch~~ and prismatic cells.

Exception No. 2: Pouch cells need not comply with this test, but pouch cells with a capacity greater than 300 mAh shall comply with the Narrow Bar Crush Test in Section 14A or the Dent Test in Section 14B.

14A Narrow Bar Crush Test

14A.1 With reference to Exception No. 2 in 14.2, pouch cells greater than 300 mAh shall be evaluated with this test or the Dent Test in Section 14B.

14A.2 Fully charge the sample with the method recommended by the manufacturer, store the charged sample for 60 ±10 min, and then measure its open-circuit voltage OCV₁.

14A.3 Position the sample on a flat surface and place a 25-mm (1-in) wide rectangular bar (with a R5 mm chamfer and thus 15 mm (0.6 in) contact width) on top of the sample. The bar shall be positioned in such a way that its edge is aligned with the top edge of the cell body, and its longitudinal axis shall be perpendicular to longitudinal axis of the sample. See 14A.5, and Figures 14A.1 and 14A.2.

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