

## COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS AND ON THE GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS

Sub-Committee of Experts on the Transport of Dangerous Goods

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Item 7 of the provisional agenda

### MISCELLANEOUS PROPOSALS OF AMENDMENTS TO THE MODEL REGULATIONS ON THE TRANSPORT OF DANGEROUS GOODS

#### Report of the Informal Working Group on Lithium Batteries

Transmitted by the Chairman of the Working Group (United States of America)

1. The Informal Working Group on Lithium Batteries met under the Chairmanship of Charles Ke, USA, in Washington, D.C. from 11-13 November 2008, to discuss the test methods relevant to lithium cells and batteries as contained in the UN Manual of Tests and Criteria.
2. Experts from China, France, Germany, Spain, United Kingdom and United States of America, as well as representatives from Battery Association of Japan (BAJ), Council on Safe Transportation of Hazardous Articles (COSTHA), International Federation of Airline Pilots' Associations (IFALPA), Airline Pilots' Association (ALPA), Japanese Automobile Research Institute (JARI), kiloFarad International (KFI), Portable Rechargeable Battery Association (PRBA) and Underwriters Laboratories (UL) participated in the work.
3. The terms of reference for the meeting were set forth in paragraph 57 of ST/SG/AC.10/C.3/2008/CRP.5/Add.5. The informal working group dealt with the following mandate:
  - (a) Review the testing requirements for lithium batteries (tests 1 to 8);
  - (b) Assess the differences between small and large batteries and the applicable testing requirements;
  - (c) Assess the relevance of current transport requirements and propose amendments if necessary

4. At the meeting, nine (9) presentations were made to the working group. The following is a list of the presentations and the presenters:

**Test Methods:**

- (a) Safety of Lithium Batteries – Battery Association of Japan
- (b) Experience with UN Tests – Underwriters Laboratories
- (c) Testing Experiences – Motorola
- (d) Definition and new test type in UN 38.3 – China
- (e) Test Equipment and Criteria – China

**Test Requirements:**

- (f) Ideas for UN Testing Requirements – PRBA
- (g) Battery Assembly Test for UN Transportation Manual of Tests & Criteria (Lithium-ion Batteries) – JARI
- (h) Impacts of Vibration and Shock Tests on Large Lithium-ion Batteries – Delphi Corp.
- (i) Definition for Large Rechargeable Battery – China

5. Additional information on these presentations are available at: [http://prba.org/laws\\_and\\_regulations/un\\_wg\\_meeting\\_on\\_lithium\\_batteries/Default.ashx](http://prba.org/laws_and_regulations/un_wg_meeting_on_lithium_batteries/Default.ashx). No proposal on transport requirements were made to the working group, therefore, this topic was not discussed at this meeting.

6. The group first discussed the adequacy of the existing test methods including test procedures and criteria. It reached a consensus opinion that the existing test methods are adequate to address safety concerns of lithium cells and batteries. The expert from China stated that he has seen a high rate of failure on Test T.6 when applied to coin cells. Other experts stated that they did not have the same experience. The expert from the USA mentioned that Test T.6 was introduced in 1999-2000 biennium to replace the old T.4 Internal Short Test. Several experts expressed interest in pursuing some type of internal short test including BAJ's "Forced Internal Short Test", UL's "Blunt Nail Penetration Test, and "NASA Internal Short Test". However no consensus could be reached on this subject.

7. The group also discussed the experience and difficulties encountered with testing cells and batteries in accordance with the UN tests. Experts from China and Motorola stated that many definitions, and terminology used in the UN Tests for lithium batteries are not consistent, not clear of its meaning, and not harmonized with other standards. Several experts said that there is a need to review the entire text of Section 38.3 of the UN Test Manual.

8. Following the above discussion the working group identified the following areas as warranting further work:

- (a) The criteria for the thermal test (T.2) needs to be re-evaluated;
- (b) The test method for the impact test (T.6) needs to be examined and alternative test methods should be considered;
- (c) The “definition” and “terminology” in Section 38.3 of the test manual need to be reviewed to improve clarity and enhance harmonization with other recognized standards.

9. The working group reviewed the requirements of performing UN Tests on lithium cells and batteries. It reached a consensus opinion that Tests T.1, T.2, T.3, T.4, T.5, T.6 and T.8 are required for cells while T.1, T.2, T.3, T.4, T.5 and T.7 are required for batteries. The testing requirements for single cell batteries was discussed. Some experts were of the opinion that single cell batteries should be treated as cells, other experts stated that they should be subject to T.7 test for batteries because they are designed to be used as batteries. No consensus was reached on this issue.

10. The group next discussed the relevance and problems associated with performing UN T.3 and T.4 tests on large batteries. Several experts stated that the current test criteria are not suitable for large batteries because at the currenting specified  $g_n$  value applicable to the T.3 test, large batteries were subjected to excessive forces not practically expected in real transport environments. Some experts suggested that the  $g_n$  values used for the T.3 and T.4 tests may be better based on the gross weight of the batteries rather than the electrochemical capacity of the batteries. In these two tests the forces applied to the batteries are more relevant to the gross weight of the batteries. However, the group could not reach a consensus on a proposal to revise the vibration  $g_n$  value, in the range of  $2 g_n - 8 g_n$ , for testing large batteries because of insufficient information. The group reached a consensus opinion that “large battery” could be defined as a battery with a gross weight of more than 12 kg. With this opinion, the T.4 Test is no longer an issue because testing requirements for small and large batteries are already addressed in the current test manual.

11. The group discussed the testing requirements for battery assemblies. An assembly consists of multi battery units, often refer to as modules, electrically connected to function as a unit. Several experts expressed the opinion that since the batteries and cells in the battery unit are fully tested, there is no need to test the assembly. In general, the group is of the opinion that further testing of a battery assembly would not be required if the component batteries are fully tested, but further study particularly concerning evaluation of the effectiveness of overcharge and short circuit protection on the assembly is required before a decision can be made.

12. After discussing each of the tests, the group identified the following areas for further study:

- (a) Resistance requirement of the External Short-Circuit Test (T.5);
- (b) Vibration and Shock Test (T.3 and T.4) as applied to different sizes of batteries;
- (c) Overcharge tests for battery assemblies including clarifying definitions between cells, batteries, modules and assemblies.

13. The group concluded that an additional meeting is needed to discuss proposals generated from those areas of further studies identified in Paragraph 14. Tentatively, the meeting shall be convened in April-May, 2009. Specific date and place will be finalized during the December 2008 UN Sub-Committee meeting.

14. Areas requiring further study and focal points for each area are listed below. Proposals should be submitted to the chairman (Charles Ke, USA) before March 31, 2009 for discussion at the next working group meeting.

Revise criteria for the T.2 Test: (Energizer, Marc Boolish)

Evaluate test method for the Impact Test T.6: (Energizer, Mike Babiak), (UL, Laurie Florence)

Definitions and terminology used in the UN Tests: (China, Chen Zhengcai)

Overcharge Resistance: (BAJ, Mitsuzo Nogami)

Vibration and shock (COSTHA, Tom Ferguson)

Assembly (PRBA, George Kerchner)

15. At the conclusion of the lithium battery discussions, a brief discussion took place relevant to the risks and classification of ultracapacitors. A representative from KFI briefed the group on current applications for ultracapacitors, the necessity of developing appropriate transport regulations, and KFI's proposed approach to the classification of ultracapacitors. The representative from France (INERIS) also briefed the group on their studies related to the hazards associated with ultracapacitors which indicated ultracapacitors generally pose a low risk in transport. Several experts provided both KFI and France (INERIS) with comments and opinions for further considerations.

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