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**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

Twenty-eighth session, 28 November-7 December 2005  
Item 5 of the provisional agenda

LISTING, CLASSIFICATION AND PACKING

Proposed amendment of lithium ion cell and battery size limits in SP 188

Transmitted by the Portable Rechargeable Battery Association (PRBA)

1. At its twenty-seventh session, the Sub-Committee considered three proposals from PRBA in document ST/SG/AC.10/C.3/2005/13. To facilitate discussion, PRBA has chosen to resubmit revised versions of the proposals in three separate documents. This document restates proposals to amend the lithium ion cell and battery size limits in Special Provision 188, provides the supporting justifications for this proposed change, and responds to related questions from the twenty-seventh session. In addition, a separate PRBA Information Paper (ST/SG/AC.10/C.3/2005/43) provides detailed information describing lithium ion cells and batteries and information relevant to their transport.

**Background**

2. Since the 12th revision, Special Provision 188 of the UN Model Regulations has allowed lithium ion cells with a lithium equivalent content of 1.5 grams or less and lithium ion batteries with an aggregate equivalent lithium content (ELC) of 8 grams or less to be transported as “not subject to other provisions of the Regulations,” provided they are tested pursuant to the requirements in Section 38.3 of the Manual of Tests and Criteria (along with other requirements). Prior to the 12th revision, lithium ion cells with an ELC of up to 5 grams (61.7 Wh) and batteries with up to 25 grams (308.3 Wh) could be transported under Special Provision 188. The more stringent limits were adopted after a lithium primary battery incident at Los Angeles Airport where batteries were severely abused (some run over by fork lift trucks) ultimately leading to the burning of two pallets of batteries. Even though lithium ion batteries were not involved in the incident, the size limits for lithium ion batteries in Special Provision 188 also were changed. In spite of the UN amendments that went into effect in 2003, lithium and lithium ion cells and batteries with no more than 5 grams and 25 grams, respectively, are still excepted (not subject to the regulations) in both the United States and Canada provided certain requirements are met. In addition, the ICAO Technical

Instructions authorizes passengers to carry lithium ion batteries with up to 25 grams of ELC in carry-on baggage.

3. There is no actual scientific basis for the limits in Special Provision 188. In adopting the limits for lithium ion batteries in Special Provision 188, the Sub-Committee has in the past exercised a certain amount of pragmatism, selecting limits that would not adversely and unnecessarily impact the movement of consumer electronic equipment.

4 The ever increasing desire for more powerful portable consumer electronic equipment prompts PRBA to ask the Sub-Committee to reconsider the existing limits. Some equipment manufacturers are already using two batteries in certain equipment in order to avoid having to consign their portable electronic equipment as dangerous goods. Use of two batteries is more costly, is less efficient than having a single battery and is less convenient to the user. Further, having two batteries directly adjacent to one another in the equipment provides little or no safety benefit over one single larger battery.

5. The idea of using larger fully regulated batteries in consumer electronic devices is even less practicable. Portable devices are frequently transported from equipment manufacturers to retailers and directly to customers by parcel carriers. At present, transporting consumer electronic devices with batteries containing more than 8 grams equivalent lithium content would require that such equipment be transported under UN 3091 as dangerous goods, would significantly increase transport costs and would affect portions of the transport industry not accustomed to dealing with dangerous goods. Additional costs would stem from compliance with employee training, packaging, marking and labelling, and shipping paper requirements as well as surcharges (about \$30 US) parcel carriers commonly impose for transporting dangerous goods. When one considers that consumers also have occasion to offer for transport portable electronic equipment by commercial carriers (e.g., to return a device back to the manufacturer) and that if batteries larger than the current SP 188 limit were used the consumer would be a dangerous goods offer or in such instances, the impracticality of using batteries exceeding the SP 188 limit is apparent.

#### **Discussion of the PRBA Proposal**

6. PRBA recognizes that the Sub-Committee must make its decisions on the basis of safety and is not suggesting that the Sub-Committee amend the current requirements simply on the basis of consumer needs. Rather PRBA is proposing that through alternative requirements, larger batteries could be authorized while maintaining or even improving the current level of safety for transporting lithium ion batteries.

7. Under the present requirements, all lithium ion batteries are allowed to be transported fully charged (100% state of charge). PRBA is proposing that the requirements be amended so that, except for very small cells and batteries, the state of charge for lithium ion cells and batteries in transport be limited to 50%, while at the same time allowing cells with up to 25 Watt-hours (2 grams ELC) and batteries with up to 200 Watt-hours (16 grams ELC) to be transported subject to the provisions in Special Provision 188. Even with the increased cell and battery size limits, the level of safety provided by the regulations would be enhanced when taking into account the introduction of the 50% state of charge limit (see paragraph 11 of ST/SG/AC.10/C.3/2005/43).

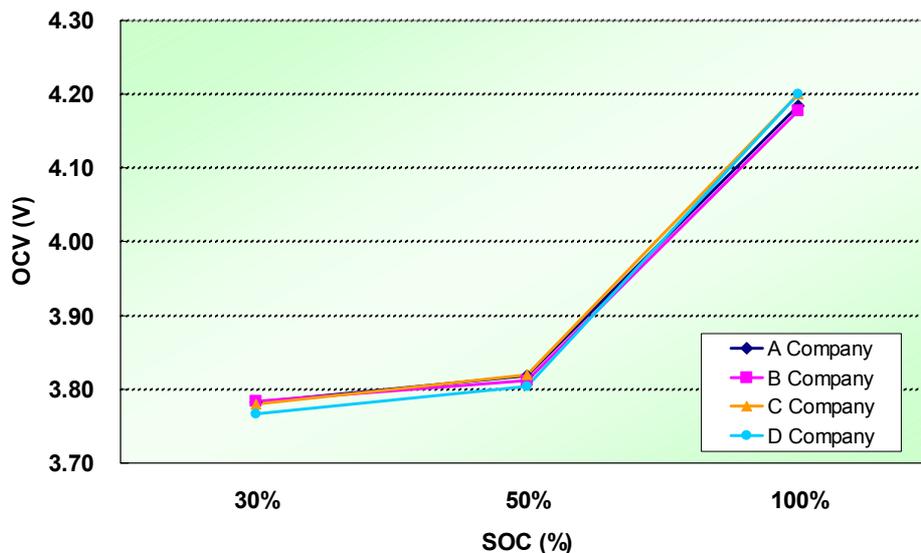
#### **Comments by the European Portable Battery Association (EPBA)**

8. EPBA, in document UN/SCETDG/27/INF.29, noted that the PRBA proposal in ST/SG/AC.10/C.3/2005/13 discussed at the twenty-seventh session would adversely impact industry practices in relation to small lithium ion cells of 100 mAh or less and requested an exception from the 50% SOC requirement for these cells. These very small cells, often referred to as "button cells", are

typically no more than 2.5 cm in diameter and have an ELC of 0.3 grams (3.75 Wh) or less. PRBA agrees with EPBA's comment and has modified the proposal below accordingly.

### **Verification of the State of Charge**

9. During the discussion at the twenty-seventh session, some delegations expressed concern over the ability to verify the state of charge of a cell or battery. For any given lithium ion cell or battery design type, the state of charge varies with the open circuit voltage of the cell or battery. The state of charge and open circuit voltage for typical lithium ion cells is provided in the figure below. Similar relationships exist for batteries.



10. A cell or battery manufacturer offering a lithium ion cell or battery for transport would be accountable for ensuring that the 50% state of charge is not exceeded. It would be the responsibility of the manufacturer to maintain a quality control system to ensure that the requirement is met. In transport, when the state of charge is in doubt, the voltage could be measured and state of charge could be determined from a graph like the one shown above. PRBA recognizes that state of charge is not immediately apparent by on-site inspection; however, this is not unlike other provisions in the UN Model Regulations. The proper classification of a substance in transport, verification that a package actually meets the performance requirements indicated, and that cylinders have been constructed and inspected in accordance with the applicable requirements are all examples of requirements that require testing and/or careful examination of documentation.

### **Risk Analysis**

11. At the twenty-seventh session, one delegation suggested that PRBA provide a risk analysis for the changes being proposed. Document ST/SG/AC.10/C.3/2005/43 identifies the risks that lithium ion cells and batteries pose, considers previous transport accident data, and describes the results of fire testing and testing on the degree of danger posed by lithium ion batteries transported at various states of charge.

### **Proposal**

12. On the basis of the above discussion, PRBA proposes the following amendments:

- .1 amend SP188 as follows (includes amendments from ST/SG/AC.10/C.3/2005/45 and -/C.3/2005/46 shown in italics and new changes introduced by this document in bold italics):

188 ~~Lithium~~ Cells and batteries offered for transport are not subject to other provisions of these Regulations if they meet the following:

- (a) For a lithium metal or lithium alloy cell, the lithium content is not more than 1 g, and for a lithium ion cell, the ~~lithium equivalent content~~ *Watt-hour rating* is not more than ~~1.5 g~~ **25 Wh**;
- (b) For a lithium metal or lithium alloy battery the aggregate lithium content is not more than 2 g, and for a lithium ion battery, the ~~aggregate lithium equivalent content~~ *Watt-hour rating* is not more than ~~8 g~~ **200 Wh**. *Lithium ion batteries subject to this provision shall be marked with its Watt-hour rating on the outside case*;
- (c) ***Except when installed in or packed with equipment and for small lithium ion cells or batteries of 100 mAh or less, lithium ion cells and batteries are offered for transport at no more than 50% state of charge***;
- (~~d~~) Each cell or battery is of the type proved to meet the requirements of each test in the Manual of Tests and Criteria, Part III, sub section 38.3;
- (~~e~~) Cells and batteries are separated so as to prevent short circuits and are packed in strong packagings, except when installed in equipment; and
- (~~f~~) Except when installed in equipment, each package containing more than 24 ~~lithium~~ cells or 12 ~~lithium~~ batteries shall in addition meet the following requirements:
  - (i) Each package shall be marked indicating that it contains lithium batteries *or lithium ion batteries, as appropriate*, and that special procedures should be followed in the event that the package is damaged;
  - (ii) Each shipment shall be accompanied with a document indicating that packages contain lithium batteries *or lithium ion batteries, as appropriate*, and that special procedures should be followed in the event a package is damaged;
  - (iii) Each package is capable of withstanding a 1.2 m drop test in any orientation without damage to cells or batteries contained therein, without shifting of the contents so as to allow battery to battery (or cell to cell) contact and without release of contents; and
  - (iv) Except in the case of lithium batteries *or lithium ion batteries* packed with equipment, packages may not exceed 30 kg gross mass.  
As used above and elsewhere in these Regulations, "lithium content" means the mass of lithium in the anode of a lithium metal or lithium alloy cell; ~~except in the case of a lithium ion cell the "lithium equivalent content" in grams is calculated to be 0.3 times the rated capacity in ampere hours.~~

- .2 amend the definitions in 38.3.3.2 of the Manual of Tests and Criteria by adding a definition for *State of charge* as follows:

***“State of charge means the available capacity in a cell or battery, after a charge or discharge operation, expressed as a percentage of the cell or battery’s rated capacity.”***

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