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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

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Item 7 of the provisional agenda
New proposals for amendments to the Model Regulations on the Transport of Dangerous Goods

Raising the 100 Wh limit for the packaging and labelling requirements of small excepted Lithium-Ion batteries under SP 188

Transmitted by the European Association for Advanced Rechargeable Batteries (RECHARGE)[1]

Introduction

1. The United Nations Model Regulations provides under SP188 an exception from full regulation on packaging and labelling for Lithium-ion batteries (UN 3480 and UN 3481) with a rating up to 100 Wh. The 100 Wh energy content limit was set some years ago when most consumer-type Lithium-Ion batteries contained much less energy (as illustrated in para. 4 below).

2. A request to raise the 100 Wh limit for the packaging and labelling requirements of small excepted Lithium-Ion batteries under SP 188 was first addressed by RECHARGE to the ADR/RID/ADN Joint Meeting in Geneva, 15-19 September 2014.

3. The Joint Meeting recommended to address the request for raising the energy limit of excepted batteries to the Sub-Committee of Experts for the Transport of Dangerous Goods.

4. The majority of the Lithium-Ion batteries on the market with an energy content between 100 and 300 Wh per battery are used typically for cordless power tools and garden/forestry equipment. In comparison, Lithium-Ion batteries used for Laptops (50 – 80

[1] In accordance with the programme of work of the Sub-Committee for 2013–2014 approved by the Committee at its sixth session (refer to ST/SG/AC.10/C.3/84, para. 86 and ST/SG/AC.10/40, para. 14).

Wh), Tablets (30 – 50 Wh) and Mobile Phones (10 – 14 Wh) have a lower energy content while most Lithium-Ion batteries used for E-bikes have an energy content above 300 to 400 Wh per unit. In this application the battery is installed in the vehicle while in the case of handheld tools, the equipment needs to be carried by an individual.

5. In the hand held cordless power tool, garden and forestry product market, most Lithium-Ion battery packs offered for transport under UN 3480 and UN 3481 still have an energy content lower than 100 Wh but rapid cell and battery pack development are leading to a significant percentage of high power batteries exceeding 100 Wh aimed at the professional tool market. Lithium-Ion battery technology is developing fast in energy to weight as illustrated in Annex 1.

Precedent in national transport regulations

6. The US Department of Transportation anticipated this technical evolution and the implications on consumers and small businesses by authorizing the transport by road of Lithium-Ion batteries (UN 3480 and UN 3481) under a lighter regime for packaging and labelling similar to what is currently required under Special Provision 188 of the ADR.

Updated in August 2014, the U.S. Hazardous Materials Regulations in its 49 Code of Federal Regulations (CFR), Part 173 (paragraph c) Exceptions, sub-paragraph iv, authorizes the transport of Lithium-Ion batteries and cells (UN 3480 and UN 3481) under which the packaging and labelling of Lithium-Ion batteries up to 60 Wh per cell and 300 Wh par battery are partially exempted from the regulation for shipments by road and rail. The text of this exception is reproduced below:

(iv) For transportation by highway or rail only, the lithium content of the cell and the battery may be increased to 5 g for a lithium metal cell and 25 g for a lithium metal battery and 60 Wh for a lithium ion cell or 300 Wh for a lithium ion battery provided the outer package is marked: "LITHIUM BATTERIES – FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT and VESSEL."

Transport Canada has a very similar provision for Lithium-Ion batteries and cells in its Transport of Dangerous Goods Regulations (TDGR) which is found in Special Provision 34:

See http://wwwapps.tc.gc.ca/Saf-Sec-Sur/3/sched-ann/schedule2.aspx.

Safety Aspects/ Testing Requirements

7. When considering the safety aspects linked to the transport of such Lithium-Ion cells and batteries with an increased energy content, the following elements need to be considered.

(a) All cells and battery packs put on the market today must be manufactured and tested in accordance with the requirements of Section 38.3 of the Manual of Test and Criteria.

(b) Battery pack manufacturers will retest the battery packs using the certification protocol of the cell manufacturer and conduct the battery pack test of IEC 62133, which is necessary for the qualification of the whole system including tool and charger. In addition the tests T1-T8 of Section 38.3. of the Manual of Tests and Criteria will be conducted and a written confirmation on the successful passing of these tests are provided on demand from Competent Authorities.

(c) In addition, manufacturers of handheld power tool and forestry equipment batteries include the following safety features in their batteries:

- Robust battery pack design and construction to withstand the drop test
- Protected terminals to avoid shorting
- Electronic monitoring and protection including fusible links and single cell monitoring.
- Tools are usually shipped in moulded kit boxes with one battery inserted in the tool and one battery retained securely in the moulding.

Safety Aspects/Transport of individual cells by comparison

8. Currently up to 30 kg of Lithium-Ion cells with an energy content lower than 20 Wh can be shipped with less restrictive packaging and labelling requirements as they are exempted under SP188. By comparison, an equivalent packaging containing tool batteries rated at 216 Wh per unit must be transported fully regulated even if the cells used in the cordless tool battery and contained in the packaging have an energy content lower or close to 20 Wh per unit. We have detailed this calculation in Table 1 which is supplied in Annex 2.

Considering the energy embarked in a packaging containing individual cells or batteries used in cordless tools, it appears that the energy density of packaging containing cordless tool batteries is lower than the energy density of packages containing individual cells which are exempted from packaging and labelling requirements. A comparison of both cases is illustrated in Annex 2 and Annex 3.

Scope of application

9. The Cordless Tool industry manufactures battery packs in various parts of the world and typically ships to Europe in bulk, packed with and contained in tools by sea freight in containers. Very little airfreight is used because of the weight. So the biggest impact to the industry of the regulation on packaging and labeling of Lithium-Ion batteries is the shipment of products from European warehouses to European customers by road and rail transport. There are transport by ferries (e.g. to the United Kingdom, Scandinavia) but 90% of shipments are by road and rail.

10. As a final point we would like to draw the Sub-Committee's attention to the proposed upper limit of 300 Wh for the battery energy content which is related to the maximum desirable weight of the hand held tool (including the battery) from a health and safety perspective.

11. Aware that this proposal may create a different type of risk in air and maritime transport, RECHARGE would limit the application field of the proposal to ground transport as granted in the US 49 CFR and the Canadian Transport Regulation (para. 6 above).

12. As a conclusion, our proposal is aimed at excepting lithium ion batteries up to 300 Wh from the labelling and packaging requirements for road and rail transport as currently provided for under SP188 for Lithium-Ion batteries rated up to 100 Wh.

Proposal

13. On the basis of the above discussion, RECHARGE proposes the following new special provision SPXXX in reference to Special Provision 188.

Existing Special Provision 188.

"188 Cells and batteries offered for transport are not subject to other provisions of ADR if they meet the following:

(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 Watt-hour rating is not more than 100 Wh. Lithium ion batteries subject to this provision shall be marked with the Watt-hour rating on the outside case, except those manufactured before 1 January 2009;

Proposed new special provision:

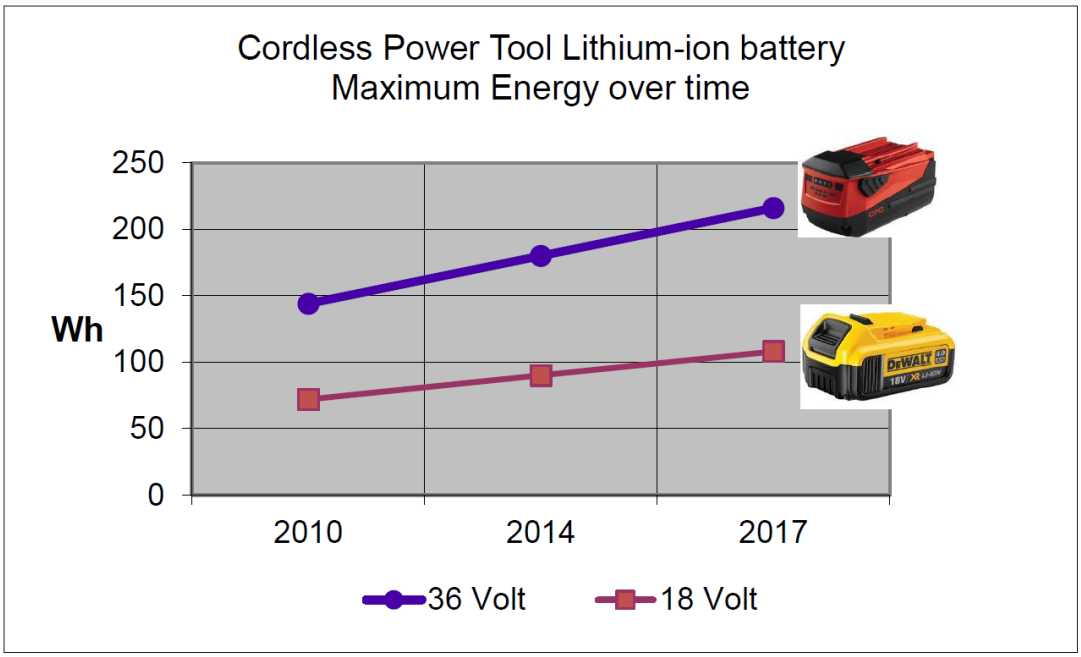
"SPXXX"

For transport operations not involving a maritime journey or air transport, the maximum watt hour rating specified in special provision 188 (b) may be raised from 100Wh to 300Wh".

Annex 1

The continuous technology development in Li-ion batteries has considerably improved the performance of this rechargeable battery technology over the last 10 years. In particular, a more efficient design and use of the active materials has allowed for a significant increase of the energy content for a given weight (energy density in Wh/kg) as shown in Figure 1. Similar improvements have been made with respect to volume (energy density in Wh/liter). As a result, batteries with the same weight and volume have an increased energy content.

Figure 1



Annex 2

Explanation of the data supplied in Table 1 below.

(a) For a given reference of e.g. 30 kg net weight of standard Lithium-ion cells, the energy content of a package filled with 600 individual cells of 50 g/unit and 10.8 Wh per cell reaches 6.5 kWh – Case 1.

(b) Within an equivalent package of 30kg, one could ship 25 Lithium-Ion batteries of 1200 g and an energy content of 108 Wh per unit (Case 2). In this case, the total energy embarked in the packaging would reach 2.7 kWh which represents an amount of energy equivalent to 42 % of the energy content of a packaging filled with individual cells as described in (a) above.

(c) In a comparative example with cells of higher capacity (6.0 Ah versus 3.0 Ah in cases (a) and (b)), one could transport 16 Lithium-Ion batteries of 1800 g and an energy content of e.g. 216 Wh per unit (Case 3). In this case, the total energy embarked in the packaging would reach 3.5 kWh which represents an amount of energy equivalent to 53 % of the energy content of a packaging filled with individual cells as described in (a) above.

Table 1

Packaging of Lithium-ion cells and batteries: comparison of technical parameters of individual cells and two types of batteries used in cordless power tools

#	Battery Types	Voltage (V)	Capacity / Unit (Ah)	Energy/Unit (Wh)	Unit Weight (kg)	30 Kg Packaging (Nb of units)	30 Kg Packaging Total Energy (kWh)	Ratio Energy Content Packs vs Cells (in %)	Transport Regulation
1	18650 cells only	3,6	3	10,8	0,05	600	6,5	100%	Exempted SP 188
2	Battery Pack 1 made of 18650 cells	36	3	108	1,2	25	2,7	42%	Full ADR
3	Battery Pack 2 made of 18650 cells	36	6	216	1,8	16	3,5	53%	Full ADR

Annex 3

Illustration of a package with 192 individual 18650 Lithium-Ion cells (left) and of a Cordless Power Tool Battery (right) made of 18650 cells.

In a battery for cordless power tools, the cells are individually protected against short-circuit, they are assembled in order to prevent the movement in the power tool. A safety system is in place to protect them against inadvertent activation during transport.

The energy density of a power pack is lower than the energy density of individual cells packed all together while being exempted from the labelling and packaging requirements.

Currently the package containing 192 individual Lithium-Ion cells (18650 type) is exempted from some provisions of the transport regulation while the package with an equivalent weight made of cordless tolls packs is transported fully regulated (see Table 1 in Annex 2).

Annex 4

EPTA: The European Power Tools Association (EPTA) represents European power tool manufacturers using rechargeable batteries in their cordless products. Cordless power tools are the fastest growing segment of the power tool market with a 40% share of the power tool market. The companies represented by EPTA account for about 16,000 employees in Europe. EPTA represents around 86% of corded and cordless power tool sales in Europe (by value). The industry's annual turnover in the EU is around €3.8bn. Power tools are used both by skilled tradesmen, in a professional capacity, mainly in the construction industry, as well as home users undertaking improvement projects.