



**WORKING PAPER**

**DANGEROUS GOODS PANEL (DGP)  
MEETING OF THE WORKING GROUP OF THE WHOLE**

**Rio de Janeiro, Brazil, 20 to 24 October 2014**

**Agenda Item 5: Review of provisions for the safe transport of lithium batteries  
5.6 Miscellaneous lithium battery issues**

**UN SUB-COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS  
WORKING PAPERS ON LITHIUM BATTERIES**

(Presented by the Secretary)

**SUMMARY**

This working paper provides seven working papers which have been to the Forty-sixth session of the UN Sub-Committee of Experts on the Transport of Dangerous Goods (Geneva, 1 to 9 December 2014) submitted on issues related to lithium batteries.

**Action by the DGP-WG:** The DGP-WG is invited to consider the working papers provided in the appendix to this working paper and provide comments to the Secretariat so that an information paper might be submitted to the upcoming UN meeting.

**1. INTRODUCTION**

1.1 At the Forty-sixth session of the UN Sub-Committee of Experts on the Transport of Dangerous Goods (Geneva, 1 to 9 December 2014), seven working papers have been submitted on various issues related to lithium batteries and are provided in the attachment to this paper. They are:

- a) ST/SG/AC.10/C.3/2014/67 — Amendment to SP 310;
- b) ST/SG/AC.10/C.3/2014/89 — Appropriate hazard communication – lithium batteries and Class 9;
- c) ST/SG/AC.10/C.3/2014/90 — Including definitions for batteries in the Modal Regulations;
- d) ST/SG/AC.10/C.3/2014/101 — Consideration of what constitutes “equipment”;

- e) ST/SG/AC.10/C.3/2014/105 — Transport of lithium batteries of small production runs or prototype lithium batteries in equipment;
- f) ST/SG/AC.10/C.3/2014/107 — Requirements for packaging damaged or defective lithium batteries; and
- g) ST/SG/AC.10/C.3/2014/108 — Raising the 100Wh limit for the packaging and labelling requirements of small excepted Lithium-ion batteries under SP188.

1.2 It should be noted in particular that ST/SG/AC.10/C.3/2014/89 was prepared by the expert from the United Kingdom in response to the concerns raised by ICAO regarding the lack of appropriate hazard communication for lithium batteries and other Class 9 articles and substances.

## 2. ACTION BY THE DGP-WG

2.1 The DGP-WG is invited to consider the working papers in the attachment and provide comments to the Secretariat so that an information paper might be submitted to the UN meeting.

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**APPENDIX A**

**WORKING PAPERS TO BE CONSIDERED AT THE FORTY-SIXTH SESSION OF THE UN  
SUB-COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS**





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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****Forty-sixth session**

Geneva, 01 – 09 Dezember 2014

Item 2 (c) of the provisional agenda

**Recommendations made by the Sub-Committee on its forty-third,  
forty-fourth and forty-fifth sessions and pending issues: electric storage systems****Amendment to SP 310****Submitted by the expert from Germany<sup>1</sup>****Introduction**

1. At the last meeting of the Sub-Committee, it was decided, on the basis of proposal ST/SG/AC.10/C.3/2014/12 together with informal documents INF.16, INF.22, INF.39 and INF.62/Rev.1 prepared as a result of a lunch time working group, to apply SP 310 also to lithium batteries of small production runs or prototype lithium batteries in equipment and to update the packing provisions laid down in SP 310 accordingly.

2. Within the framework of the discussion, some of the participants noted that it made sense to include in the transport document information stating that the transport was effected in accordance with SP 310. However, as there was no proposal on this matter, no decision could be taken.

3. Compared with the packagings in accordance with P903 or LP903, the description of the packagings in the adopted wording contains additional requirements and allows for a greater flexibility with regard to the use for different types of batteries. What is more, unpackaged transport is possible under the conditions specified by the competent authority. Without further information, it is not clear within the framework of possible checks why the batteries and/or equipment have/has been packaged in deviation from the requirements laid down in P903 or LP903.

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<sup>1</sup> 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).

4. To avoid delays, information should be provided from which it can be seen that the transport operation is effected under the conditions of SP 310.

## **Proposal**

5. Insert the following letter d in SP 310:  
“(d) The transport document shall include the following statement "Transport in accordance with special provision 310.”.  
Renumber existing (d) as (e).
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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****Forty-fifth session**

Geneva, 1 – 9th December 2014

Item 2 (e) of the provisional agenda

**Recommendations made by the Sub-Committee on its forty-third,  
forty-fourth and forty-fifth sessions and pending issues: miscellaneous pending issues****Appropriate hazard communication – lithium batteries and  
Class 9****Transmitted by the expert from the United Kingdom<sup>1</sup>****Introduction**

1. At the forty-fifth session, the United Kingdom submitted ST/SG/C.10.C.3/2014/18, proposing new marks to better communicate the hazards associated with lithium batteries and other substances and articles in Class 9. This followed ICAO's expression of concern about the transport of lithium batteries (ST/SG/C.10.C.3/2013/49 and informal document INF.48 at the forty-fourth session). It also reflected the more general apprehensions about lack of information conveyed by the current Class 9 marking system voiced during debate by many members of the Sub Committee.
2. The proposals put forward in ST/SG/AC.10/C.3/2014/18 were discussed in plenary and at a lunchtime working group, the conclusions of which were summarised in informal document INF.66. The current proposal is based on the working group's recommendations, as agreed by a majority of those present.
3. For lithium batteries, the working group's conclusions were that a new marking system should:
  - (a) Indicate the main hazard (flammability) only;

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<sup>1</sup> 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).

- (b) Associate this hazard with damage to the batteries;
  - (c) Differentiate between lithium ion/lithium metal batteries;
  - (d) Adapt the battery image used by ICAO; and
  - (e) Retain existing exemptions (e.g. SP 188).
4. For Class 9 marking more generally, the conclusions were:
- (a) Add an appropriate pictogram to the lower half of the existing Class 9 label;R
  - (b) Possibly allow separate but adjacent Class 9/specific pictogram labels as an alternative;
  - (c) Use existing pictograms from the Model Regulations or GHS in so far as possible;
  - (d) Standardise on a black and white design;
  - (e) Continue existing exemptions (LQ, EQ, special provisions); and
  - (f) Require the same pictogram for exempt categories as for the corresponding regulated Class 9 entry, in diamond or rectangle, with no language and no Class mark.
5. The United Kingdom accordingly presents below three proposals for marking systems, which could be adopted singly or in combination:
- (a) For lithium batteries;
  - (b) For Environmentally Hazardous Substances (EHS) and elevated temperature entries; and
  - (c) For other Class 9 entries (asbestos, capacitors).
6. The United Kingdom would suggest that label numbers are allocated in the order these substances/articles are listed at 2.9.2, as follows:

9A – Substances which, on inhalation as fine dust, may endanger health, from GHS:



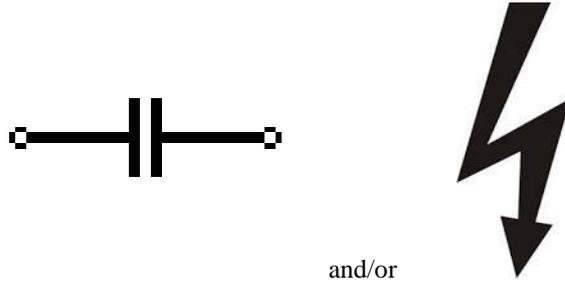
9B – Substances evolving flammable vapour, based on commercial warning signs:



9C – Lithium batteries, adapted from the ICAO label:



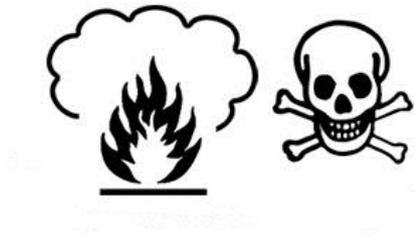
9D – Capacitors, from the electrical symbols for capacitor and current:



9E – Life saving appliances, from IMO shipboard signage:



9F – Substances and articles which, in the event of fire, may form dioxins, based on the Model Regulations' flame and toxic symbols:



9G – Substances transported or offered for transport at elevated temperatures, from 5.3.2.2 of the Model Regulations:



9H – Environmentally hazardous substances, from 5.2.1.6.3 (figure 5.2.2) of the Model Regulations:



9I – Genetically modified (micro) organisms, from the DNA double helix:



7. Further consideration should be given to the entries grouped together as ‘Other substances or articles presenting a danger during transport, but not meeting the definitions of another class’, but this is beyond the scope of this paper.

## Proposal 1

8. In the Dangerous Goods List in Chapter 3.2, add Special Provision CCC against the following UN numbers in column (6): 3090, 3091, 3480 and 3481.

9. At 3.3.1, special provision 188:

Amend point (f) to read (new text underlined):

“Except for packages containing button cell batteries installed in equipment (including circuit boards), or no more than four cells installed in equipment or no

more than two batteries installed in equipment, each package shall be marked with the following:

(i) An indication that the package contains “lithium metal” or “lithium ion” cells or batteries, as appropriate. After [31 December 2019], this requirement shall be met by application of the appropriate lithium battery mark, as illustrated at 5.2.1.9;

(ii) Existing (ii) is to be deleted. Renumber the following paragraphs accordingly;

10. At 3.3.1, special provision 376, amend the second subparagraph under the NOTE to read (new text underlined):

“Packages shall be marked “DAMAGED/DEFECTIVE LITHIUM-ION BATTERIES” or “DAMAGED/DEFECTIVE LITHIUM METAL BATTERIES”, as applicable, and [after 31 December 2019] shall be marked with the appropriate lithium battery mark, as illustrated at 5.2.1.9.”

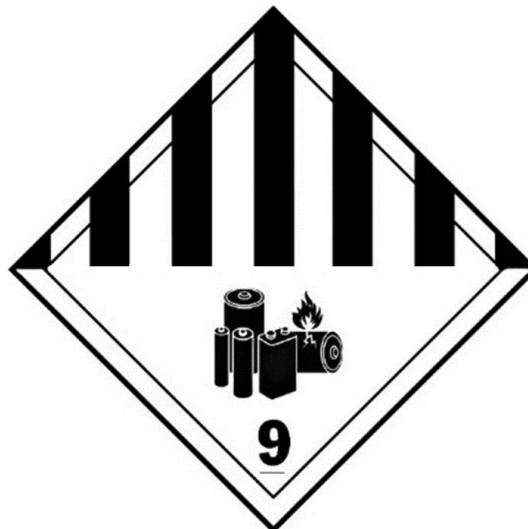
11. At 3.3.1, special provision 377, amend the third subparagraph to read (new text underlined):

“Packages shall be marked “LITHIUM BATTERIES FOR DISPOSAL” or “LITHIUM BATTERIES FOR RECYCLING”, as applicable, and [after 31 December 2019] shall be marked with the appropriate lithium battery mark or marks, as illustrated at 5.2.1.9.”

12. At 3.3.1, add a new Special Provision CCC, to read:

“The class 9 label to be used is No. 9C, see 5.2.2.2.2.”

13. At 5.2.2.2.2, under CLASS 9 Miscellaneous dangerous substances and articles, including environmentally hazardous substances, after the generic Class 9 label, add the following:



(No.9C)

Symbol (seven vertical black stripes in upper half; battery group, one broken and emitting flame in lower half): black;

Background: white;

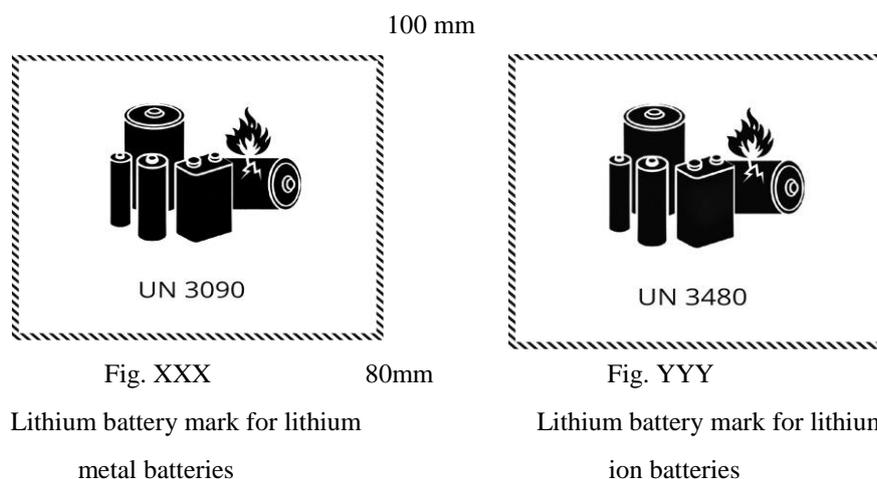
Figure “9” underlined in bottom corner’

14. Insert new 5.2.1.9, to read as follows:

*“Lithium battery marks*

The lithium battery mark to be displayed in accordance with the special provisions of Chapter 3.3 shall be as shown in figures XXX and YYY for lithium metal and lithium ion batteries respectively. In cases of a mixed load of lithium metal and lithium ion batteries, both marks shall be displayed.

Where the lithium batteries are contained in, or packed with, equipment, ‘UN 3091’ or ‘UN 3481’ should be substituted for the UN numbers shown below. In cases of a mixed load of batteries and batteries in equipment, it is sufficient to display the battery label only.



The mark shall be in the form of a rectangle with hatched edging. The dimensions shall be [100mm x 80mm] and the minimum width of the hatching shall be 5mm. The symbol (group of batteries, one damaged and emitting flame, over the UN number for lithium ion or lithium metal batteries or cells) shall be black on white. The hatching shall be black. If the size of the package so requires, the dimensions/line thickness may be reduced, provided the marking remains clearly visible.’

*Note: The format of the dimension indicators should be standardised with those used elsewhere in the Model Regulations, e.g. Figure 5.5.1.*

## Proposal 2

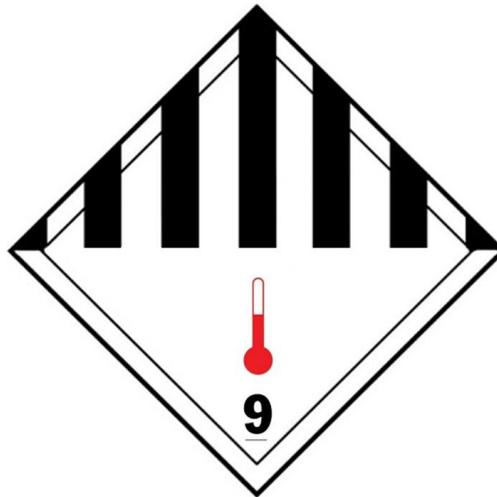
15. In the Dangerous Goods List in Chapter 3.2, add Special Provision GGG against the following UN numbers in column (6): 3257, 3258

16. At 3.3.1, add a new Special Provision GGG, to read:

“Cargo transport units shall display the class 9 placard (No. 9G), see 5.2.2.2.2, in accordance with the provisions of Chapter 5.3. As an alternative, until [31 December 2019], the provisions of 5.3.2.2 may be used.”

17. At 5.2.2.2.2, under CLASS 9, after the generic Class 9 label, in alphabetical order with other labels, add the following:

18.



(No.9G)

Symbol (seven vertical stripes in upper half; black;  
thermometer in lower half red);

Background: white;

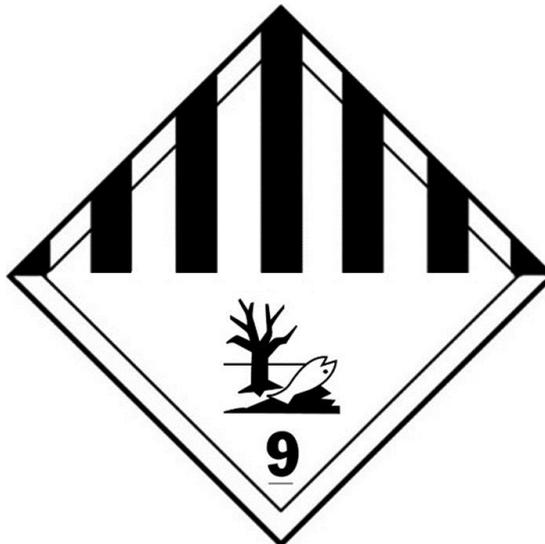
Figure “9” underlined in bottom corner’

19. In the Dangerous Goods List in Chapter 3.2, add Special Provision HHH against the following UN numbers in column (6): 3077, 3082

20. At 3.3.1, add a new Special Provision HHH, to read:

“The class 9 label to be used is No. 9H, see 5.2.2.2.2. As an alternative, until [31 December 2019], the provisions of 5.2.1.6 may be used.”

21. At 5.2.2.2.2, under CLASS 9, after the generic Class 9 label, in alphabetical order with other labels, add the following:



(No.9H)

Symbol (seven vertical black stripes in upper half, fish and tree in lower half):  
black; Background: white;

Figure “9” underlined in bottom corner’

### Proposal 3

22. In the Dangerous Goods List in Chapter 3.2, add Special Provision AAA against the following UN numbers in column (6): 2212, 2590.

23. At 3.3.1, add a new Special Provision AAA, to read:

“The class 9 label to be used is No. 9A, see 5.2.2.2.2. As an alternative, until [31 December 2019], the generic class 9 label without the aspiration hazard symbol may be used.”

24. At 5.2.2.2.2, under CLASS 9, after the generic Class 9 label, add the following:



(No. 9A)

Symbol (seven vertical stripes in upper half,  
aspiration hazard in lower half): black;

Background: white;

Figure “9” underlined in bottom corner

25. In the Dangerous Goods List in Chapter 3.2, add Special Provision BBB against the following UN numbers in column (6): 2211, 3314.

26. At 3.3.1, add a new Special Provision BBB, to read:

“The class 9 label to be used is No. 9B, see 5.2.2.2.2. As an alternative, until [31 December 2019], the generic class 9 label without the flammable vapour symbol may be used.”

27. At 5.2.2.2.2, under CLASS 9, after the generic Class 9 label, in alphabetical order with other labels, add the following:



(No. 9B)

Symbol (seven vertical stripes in upper half, figure engulfed in flame from vapour in lower half): black;

Background: white

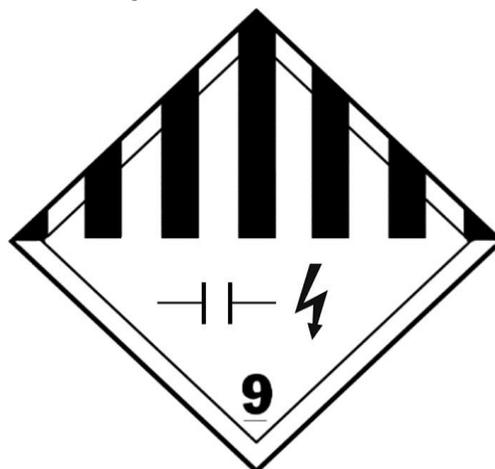
Figure “9” underlined in bottom corner’

28. In the Dangerous Goods List in Chapter 3.2, add Special Provision DDD against the following UN numbers in column (6): 3499, 3508.

29. At 3.3.1, add a new Special Provision DDD, to read:

“The class 9 label to be used is No. 9D, see 5.2.2.2.2. As an alternative, until [31 December 2019], the generic class 9 label without the capacitor and/or electric shock symbols may be used.”

30. At 5.2.2.2.2, under CLASS 9, after the generic Class 9 label, in alphabetical order with other labels, add the following:



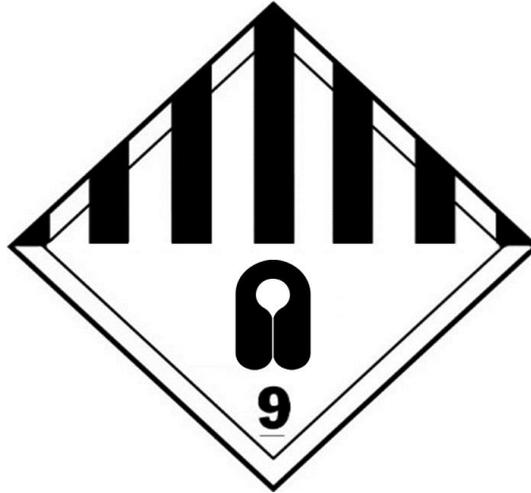
(No. 9D)

Symbol (seven vertical stripes in upper half); black;  
(capacitor and/or electric shock symbols in lower half): black;

Background: white;

Figure “9” underlined in bottom corner’

31. In the Dangerous Goods List in Chapter 3.2, add Special Provision EEE against the following UN numbers in column (6): 2990, 3072, 3268.
32. At 3.3.1, add a new Special Provision EEE, to read:  
“The class 9 label to be used is No. 9E, see 5.2.2.2.2. As an alternative, until [31 December 2019], the generic class 9 label without the life vest symbol may be used.”
33. At 5.2.2.2.2, under CLASS 9, after the generic Class 9 label , add the following in alphabetical order with other labels:



(No. 9E)

Symbol (seven vertical stripes in upper half,  
life vest symbol in lower half): black;  
Background: white;  
Figure “9” underlined in bottom corner’  
[alternative:



34. In the Dangerous Goods List in Chapter 3.2, add Special Provision FFF against the following UN numbers in column (6): 2315, 3432, 3151, 3152.
35. At 3.3.1, add a new Special Provision FFF, to read:  
“The class 9 label to be used is No. 9E, see 5.2.2.2.2. As an alternative, until [31 December 2019], the generic class 9 label without the fire induced toxic emissions may be used.”

36. At 5.2.2.2.2, under CLASS 9, after the generic Class 9 label , in alphabetical order with other labels, add the following:



(No. 9F)

Symbol (seven vertical stripes in upper half,  
flame causing toxic emissions, skull and crossbones  
in lower half): black;

Background: white;

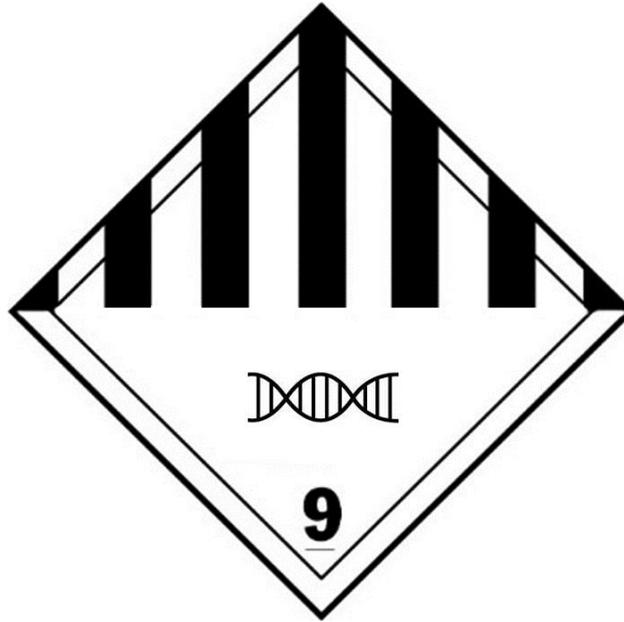
Figure “9” underlined in bottom corner’

37. In the Dangerous Goods List in Chapter 3.2, add Special Provision III against the following UN number in column (6): 3245.

38. At 3.3.1, add a new Special Provision III, to read:

39. “The class 9 label to be used is No. 9I, see 5.2.2.2.2. As an alternative, until [31 December 2019], the generic class 9 label without the DNA double helix may be used.”

40. At 5.2.2.2.2, under CLASS 9, after the generic Class 9 label, in alphabetical order with other labels, add the following:



(9I)

Symbol (seven vertical stripes in upper half,  
DNA double helix in lower half): black;  
Background: white;  
Figure “9” underlined in bottom corner’

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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****Forty-fifth session**

Geneva, 1 – 9th December 2014

Item 2 (c) of the provisional agenda

**Recommendations made by the Sub-Committee on its forty-third,  
forty-fourth and forty-fifth sessions and pending issues: electric storage systems****Including definitions for batteries in the Model Regulations****Transmitted by the Dangerous Goods Advisory Council (DGAC)<sup>1</sup>****Introduction**

1. At the forty-fifth session of the Sub-Committee DGAC suggested that it would be useful to include the definitions for “lithium cell”, “battery” and “single cell battery” in the Model Regulations. These terms are defined in the Manual of Tests and Criteria. The informal working group on testing large lithium batteries is reviewing the definitions and will likely propose amendments. The reason that DGAC suggested adding definition to the Model Regulations is because consignors must understand the difference between a cell and battery in order to comply with the exceptions provided in SP 188 for lithium batteries contained in equipment. Common consignors do not generally acquire or have access to the Manual of Tests and Criteria. On this basis, it would be useful to include these definitions in the Model Regulations.

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<sup>1</sup> 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).

## Proposal

2. It is proposed to add the following definitions, as developed by the informal working group on testing large lithium batteries\*<sup>2</sup> in 1.2.1 of the Model Regulations:

*Cell* means a single encased electrochemical unit (one positive and one negative electrode) which exhibits a voltage differential across its two terminals, and may contain its protection devices. See definitions for battery and single cell battery.

*Battery* means two or more cells or batteries which are electrically connected together and fitted with devices necessary for use, for example, case, terminals, marking ~~and~~ or protective devices. Units which have 2 or more cells that are commonly referred to as “battery packs”, “modules” or “battery assemblies” having the primary function of providing a source of power to another piece of equipment are for the purposes of the Model Regulations and the Manual of Tests and Criteria treated as batteries. See definitions for cell and single cell battery.

*Single cell battery* means a cell externally fitted with devices necessary for use in equipment or another battery which it is designed to power, for example protective devices. See definitions for cell and battery. A single cell battery is considered a “cell”.

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<sup>2</sup> These definitions will be reviewed once more by the informal working group and additional edits may be agreed in which case the Sub-Committee is invited to adopt the definitions proposed by the working group and agreed to by the Sub-Committee.



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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****Forty-sixth session**

Geneva, 1–9 December 2014

Item 2 (e) of the provisional agenda

**Recommendations made by the Sub-Committee on its forty-third,  
forty-fourth and forty-fifth sessions and pending issues: electric storage systems****Consideration of what constitutes “equipment”****Transmitted by the International Air Transport Association (IATA)<sup>1</sup>****Introduction**

1. The provisions for lithium batteries set out in Special Provision 188 and in packing instruction P903 differentiate between cells and batteries and cells and batteries installed in equipment, with lithium cells and batteries installed (contained) in equipment benefitting from certain relaxations.
2. As the use of lithium cells and batteries as a power source for various types of equipment has expanded so too has the need for users to be able to recharge their equipment and as a consequence there is now significant market for what are typically called “power packs”.
3. These power packs generally contain lithium ion batteries, although there are some that contain lithium metal cells or batteries, and are used as a portable source of power to recharge mobile phones, tablets or even laptop computers.
4. The issue around the transport of these power packs is whether they are “batteries” or “equipment”. Certainly the majority of the consignors of these devices are calling the power packs “equipment” and are therefore using the provisions set out in Special Provision 188(f) which provides for the opportunity for large numbers of the power packs

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<sup>1</sup> 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).

to be individually placed in a “package” and then assembled into a larger carton for transport purposes without the carton having to be identified as containing lithium batteries.

5. In addition to these power packs there are other components containing lithium batteries that are being shipped under the provisions of equipment rather than as batteries on the basis that the battery is fitted into a device, notwithstanding that the component being shipped is not of itself a fully functioning piece of “equipment”. Examples of these are the battery component of e-cigarettes. See Annex A for examples of power packs and e-cigarette components.

6. The relaxations provided for packages containing lithium batteries installed in equipment for articles such as laptop computers and mobile telephones as set out in Special Provision 188(f) is quite reasonable. The piece of equipment provides a degree of protection for the lithium battery, and when shipped with one or two devices in a package the risk in transport is very low, and therefore the lack of hazard communication is also reasonable.

7. However, when shipping devices that are really no more than a battery, with a casing and the provisions of Special Provision 188(f) are exploited to move hundreds or even thousands of such devices in a carton the risk profile becomes very different.

8. To address this gap it is suggested that there is a need to bring into the Model Regulations a clear determination of what must be classified as being a “battery” for the purposes of Special Provision 188 and therefore shipped as such.

9. Section 38.3 of the Manual of Tests and Criteria in 38.3.2.3 includes a definition for “battery” under which is a note, which reads:

*NOTE: Units that are commonly referred to as "battery packs", "modules" or "battery assemblies" having the primary function of providing a source of power to another piece of equipment are for the purposes of the Model Regulations and this Manual treated as batteries.*

10. The text shown in the note in this definition indicates that devices that are simply a source of power to another piece of equipment must be treated as “batteries” and not as “equipment” for the purposes of the Manual of Tests and Criteria and for the Model Regulations. It is proposed to bring the substance of this note into Special Provision 188 in the Model Regulations to try to ensure that devices that are simply a power source cannot be called “equipment” and benefit from the absence of the indication that the package contains lithium batteries.

## Proposal

11. Amend the end of Special Provision 188 to read:

...

- (i) Except when batteries are installed in or packed with equipment, packages shall 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, in addition, articles having the primary function of providing a source of power to another piece of equipment shall be classified as “batteries” and not “equipment”.

Separate entries exist for lithium metal batteries and lithium ion batteries to facilitate the transport of these batteries for specific modes of transport and to enable the application of different emergency response actions.

Appendix

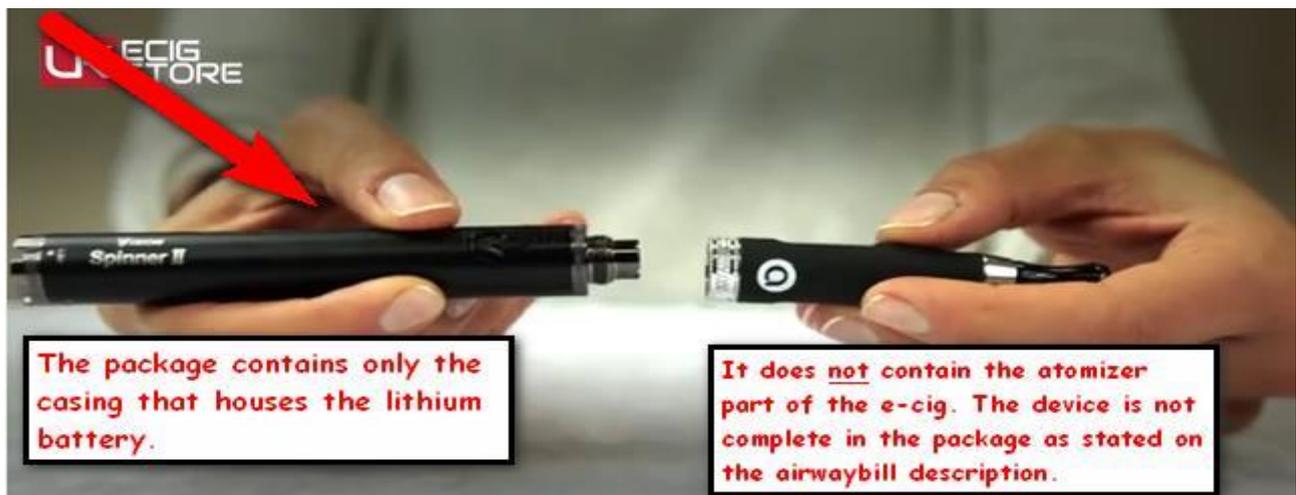
[English only]

# Rechargeable Battery Bank

for iPod, iPhone, iPad, BlackBerry, HTC, and more



e-cigarette battery component



**The package contains only the casing that houses the lithium battery.**

**It does not contain the atomizer part of the e-cig. The device is not complete in the package as stated on the airwaybill description.**



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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****Forty-sixth session**

Geneva, 1 – 9 December 2014

Item 2 (c) of the provisional agenda

**Recommendations made by the Sub-Committee on its forty-third,  
forty-fourth and forty-fifth sessions and pending issues: electric storage systems****Transport of lithium batteries of small productions runs or  
prototype lithium batteries in equipment****Transmitted by the expert from the United Kingdom<sup>1</sup>****Introduction**

1. At the forty-fifth session of the Sub-Committee, Germany submitted ST/SG/AC.10/C.3/2014/12 which subsequently led to a lunchtime working group and the development of informal documents INF.62 and INF.62/Rev. 1 on the issue of the transport of lithium batteries of small production runs or prototype lithium batteries contained in equipment.

2. The United Kingdom expert indicated that the text adopted for this kind of transport would be more appropriate as a packing instruction rather than included within a special provision. The United Kingdom expert therefore presents an alternative proposal where the text developed in informal document INF.62/Rev.1 is presented in a packing instruction as follows:

**Proposal**

3. Amend Special Provision 310 in Chapter 3.3 to read as follows:

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<sup>1</sup> 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).

“**310** The testing requirements in Chapter 38.3 of the *Manual of Tests and Criteria* do not apply to production runs consisting of not more than 100 cells and batteries, or to pre-production prototypes of cells and batteries when these prototypes are transported for testing, ~~if:~~” [The rest of the text of SP310 is deleted]

4. Insert a new packing instruction in 4.1.4.1 as follows:

“

P910	PACKING INSTRUCTION	P910
This instruction applies to UN Nos. 3090, 3091, 3480 and 3481 prototypes being transported for testing		
The following packagings are authorized provided that the general provisions of <b>4.1.1</b> and <b>4.1.3</b> are met:		
<p>(1) For prototype cells and batteries including equipment:            Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G);            Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2);            Jerricans (3A2, 3B2, 3H2).</p>		
Packagings shall conform to the packing group II performance level and shall meet the following requirements:		
<p>(a) Batteries and cells, including equipment, of different sizes, shapes or masses shall be packaged in an outer packaging of a tested design type listed above provided the total gross mass of the package does not exceed the gross mass for which the design type has been tested;</p> <p>(b) The cells and batteries shall be protected against short circuit;</p> <p>(c) Each cell or battery shall be individually packed in an inner packaging and placed inside an outer packaging;</p> <p>(d) Each inner packaging shall be completely surrounded by sufficient non-combustible and non-conductive thermal insulation material to protect against a dangerous evolution of heat;</p> <p>(e) Appropriate measures shall be taken to minimize the effects of vibration and shocks and prevent movement of the cells or batteries within the package that may lead to damage and a dangerous condition during transport. Cushioning material that is non-combustible and non-conductive may be used to meet this requirement;</p> <p>(f) Non-combustibility shall be assessed according to a standard recognized in the country where the packaging is designed or manufactured;</p> <p>(g) A cell or battery with a net mass of more than 30 kg shall be limited to one cell or battery per outer packaging.</p>		
<p>(2) For prototype cells and batteries contained in equipment:            Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G);            Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2);            Jerricans (3A2, 3B2, 3H2).</p>		
<p>(a) Equipment of different sizes, shapes and masses shall be packaged in an outer packaging of a tested design type listed above provided the total gross mass of the package does not exceed the mass for which the design type has been tested;</p> <p>(b) The cells and batteries shall be protected against short circuit;</p> <p>(c) The equipment shall be constructed or packaged in such a manner as to prevent accidental operation during transport;</p>		

- (d) Appropriate measures shall be taken to minimize the effects of vibration and shocks and prevent movement of the cells or batteries within the package that may lead to damage and a dangerous condition during transport. When cushioning material is used to meet this requirement it shall be non-combustible and non-conductive; and
- (e) Non-combustibility shall be assessed according to a standard recognized in the country where the packaging is designed or manufactured.
- (3) For unpackaged prototype batteries or equipment:
- The batteries or the equipment may be transported unpackaged under conditions specified by the competent authority. Additional conditions that may be considered in the approval process include, but are not limited to:
- (a) The equipment or the battery shall be strong enough to withstand the shocks and loadings normally encountered during transport, including transshipment between cargo transport units and between cargo transport units and warehouses as well as any removal from a pallet for subsequent manual or mechanical handling; and
- (b) The equipment or the battery shall be fixed in cradles or crates or other handling devices in such a way that it will not become loose during normal conditions of transport.

**Additional requirement**

Prototype damaged or defective cells and batteries shall be transported in accordance with special provision 376 and packaged in accordance with P908 of 4.1.4.1 or LP904 of 4.1.4.3, as applicable.

5. Assign packing instruction P910 to UN Nos. 3090, 3091, 3480 and 3481 in column 8 of the Dangerous Goods List in Chapter 3.2.
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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****Forty-sixth session**

Geneva, 1 – 9 December 2014

Item 7 of the provisional agenda

**New proposals for amendments to the Model Regulations on the Transport of Dangerous Goods****Requirements for packaging damaged or defective lithium  
batteries****Transmitted by the Dangerous Goods Advisory Council (DGAC)<sup>1</sup>****Introduction**

1. P908 and LP904 provide packaging requirements for damaged or defective lithium cells and batteries including those contained in equipment. Each of these packing instructions requires packaging to conform to a packing group II performance level.
2. Paragraph 2 of each of these packing instructions requires each inner packaging to be surrounded by sufficient non-combustible and non-conductive thermal insulation material to protect against a dangerous evolution of heat.
3. Paragraph 4 of each of these packing instructions requires appropriate measures be taken to minimize the effects of vibrations and shocks and to prevent movement of the cells or batteries that may lead to further damage and a dangerous condition during transport. Each of these packing instructions permits the consignor to meet this provision by the use of cushioning material, and requires that the cushioning material used be non-combustible and non-conductive.
4. Experience developing packaging for the transport of damaged or defective batteries has shown that cushioning material that is combustible can be used effectively without contributing to the severity of a thermal runaway involving a lithium ion or metal battery or

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<sup>1</sup> 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).

the ability of a thermally insulated packaging to contain a thermal runaway. Packagings have been developed and successfully tested using combustible cushioning material such as paper, fiberboard separators and sealed air bubble wrap.

5. In many instances damaged lithium batteries need to be transported from locations where non-combustible cushioning is not readily available. There are limited non-combustible cushioning materials available that can be used for shipping damaged lithium batteries. The most important design feature related to packagings intended for the transport of damaged or defective batteries is the thermal insulation that is specified in paragraph 2 of P908 and LP904.

## **Proposal**

6. It is proposed to amend P908 and LP904 as follows:

### **Alternative 1**

Replace the sentence in paragraph 4 that reads: “Cushioning material that is non-combustible and non-conductive may also be used to meet this requirement.” with the sentence: “Appropriate non-conductive cushioning material may be used to meet this requirement.”.

### **Alternative 2**

Add the following sentence to the end of paragraph 4: “Cushioning material need not be non-combustible if through testing it can be demonstrated that combustible cushioning materials can be used without contributing to the severity of a thermal reaction or the ability of the packaging to contain a thermal event.”

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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)<sup>1</sup>****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

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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 per 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://www.wapps.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:**

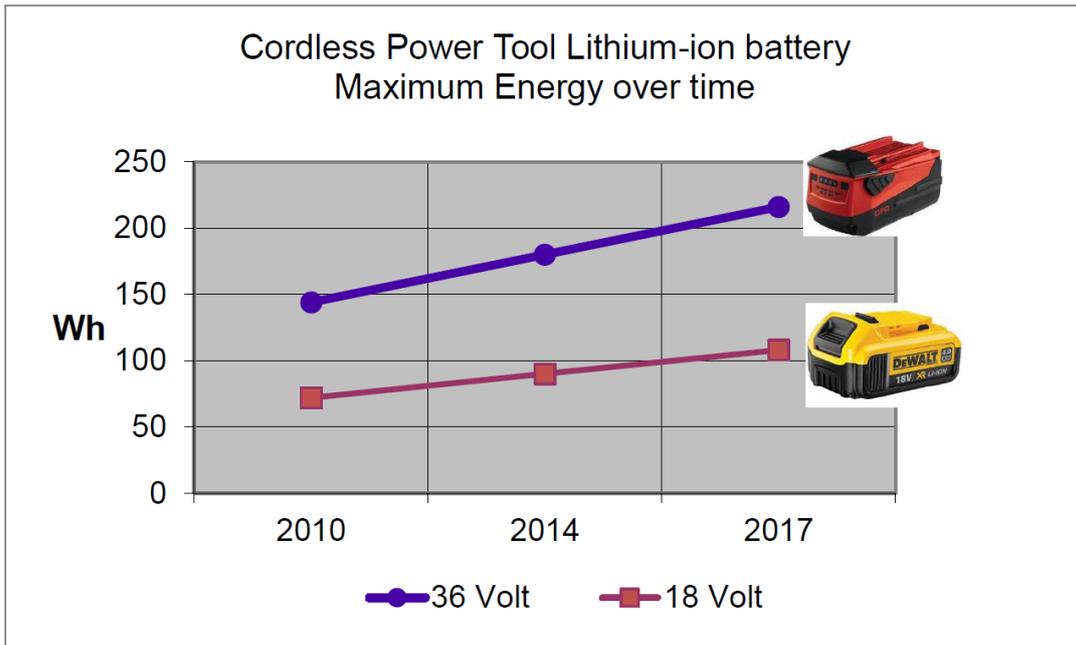
“SPXXX”

*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 tools 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.

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