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WORKING PAPER

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

Auckland, New Zealand, 4 to 8 May 2009

Agenda Item 5: Resolution, where possible, of the non-recurrent work items identified by the Air Navigation Commission or the panel
5.3: Review of provisions for dangerous goods relating to batteries
a) lithium batteries
b) battery-powered devices
c) battery-powered mobility aids

LITHIUM BATTERIES

(Presented by H. Brockhaus)

SUMMARY

With this paper, Germany would like to provide information on the perhaps necessary changes to dangerous goods transportation regulations for air transportation of large rechargeable lithium batteries, e.g. for electrical road vehicles and for energy storage in the renewable energy sector. This is necessary due to the international proliferation of such new batteries to allow CO_2 reduction goals to be met. Existing dangerous goods transport regulations were designed for lithium portable batteries both in terms of rules for prototypes and samples as well as for series production and tested lithium batteries.

1. INTRODUCTION

1.1 Societal goals and political guidelines for CO_2 reduction can only be met with the help of suitable technical solutions. Within this context, large rechargeable lithium batteries (from 01.01.2009 UN-Nr. 3480) could be used for storage in energy production from renewable sources such as solar, wind and hydropower, in particular in decentralized installations.

1.2 An additional focus in CO_2 reduction is to reduce consumption of fossil fuels in the automotive sector through the use of large rechargeable lithium batteries, in particular as traction batteries in hybrid and electric vehicles. The future high volume production of large rechargeable lithium batteries is, in the interim, being driven by competition between automotive companies (e.g. refer to planned developments by automobile industry etc. in 2009/2010).

1.3 International proliferation of new battery technologies to support achievement of the goals described above is directly linked with the ability to transport large rechargeable lithium batteries. As a result revision of the dangerous goods transportation regulations for large rechargeable lithium batteries, e.g. for automotive applications or as energy store for renewable energy, is urgently required. Existing dangerous goods transport regulations were mainly designed for lithium portable batteries both in terms of rules for prototypes and samples as well as for series production and tested lithium batteries

2. HIGH LEVELS OF SAFETY WITH LARGE RECHARGEABLE LITHIUM BATTERIES

2.1 Lithium batteries have been in widespread use for 15 years, in products requiring as long a duration and reliable a portable electrical supply as possible. As a result it is hard to conceive of mobile applications such as camcorders, laptops, PDAs, mobile telephones and many others without this technology.

2.2 Apart from certain special applications and samples, for which the corresponding transport regulations were defined, this battery system was never used in mobile applications requiring large currents. Technical advances, both in the basic chemistry as well as in the systems built around such cells, paved the way for this technology to be used in transportation applications and enable the development of vehicles for which other electrochemical storage systems were inadequate. Practically all automotive original equipment manufacturer (OEMs) are testing a wide variety of hybrid vehicles and pure electric vehicles, with the first vehicles close to volume manufacture and market introduction.

2.3 To meet the requirements in such applications, lithium cells with the necessary performance characteristics are subjected to comprehensive tests and then built into complex battery systems. In addition to thermal management, such batteries typically have an electrical management system which monitors and controls the conditions of each cell during charge and discharge. Such systems are typically housed in a robust secondary casing, in order that the mechanical requirements of the application can be met. The required performance data, safety requirements, reliability and operating life can only be achieved in this way.

2.4 Regarding safety tests for transportation according to subparagraph 38.3 of the UN *Manual of Tests and Criteria*, certain adaptations should be made which reflect this situation more specifically. Current tests were formulated based on the requirements of portable batteries. These are typically cells with limited capacity (typically a few ampere-hours) and relatively low voltages (typically 4 – 36V). Whereas large batteries are in principle included, this is based on special applications and samples, together with the historical technical background.

2.5 As a consequence the following items should be considered for new or when adapting the current regulations:

a) A fundamental discussion of current test requirements taking into account the latest technical background, with resulting changes to subparagraph 38.3 of the UN *Manual of Tests and Criteria*. This discussion is already taking place at the UN-level based on PRBA proposal ST/SG/AC.10/C.3/2008/46 from 16.04.2008. Some fundamental changes were already recommended in the existing UN Working Group in November 2008 and adopted by the UN in December 2008. The need for additional action was identified during the Working Group meeting in November 2008, which will be picked up by the group in mid April in Paris.

b) It must be fundamentally assumed that a wide variety of modules and batteries will be manufactured from a single certified cell. In this case it is important to check which tests for which type of assembly are required to guarantee safe transportation.

c) Consideration of the electronic measures incorporated to provide safe operation when in normal use and the positive impact of these on transportation safety.

d) Consideration of the standard, robust secondary housing and the resulting positive impact on transportation.

e) Given that large lithium batteries typically comprise not only a large number of cells connected together but also a battery management system, a robust secondary housing and in most cases a thermal management system in order that product specifications can be met, a new definition of the current criteria for small batteries (i.e. portable batteries) and large batteries (currently mostly transport application) is necessary.

f) Violations of transport regulations often happen by accident. It should therefore be evaluated, to what extent a visible quality seal — regulated by subparagraph 38.3 of the UN *Manual of Tests and Criteria* – would result in raised awareness and, to a certain extent, be effective against deliberate misuse.

3. PROPOSALS FOR NECESSARY MEASURES

3.1 With this information paper, Germany wishes to encourage discussion over perhaps required changes in the dangerous goods Technical Instructions. In order that the increased transportation requirement for such in systems from 2010/2011 onwards can be met, a working paper can be developed for the next DGP. Changes will be perhaps necessary particularly in Packing Instructions 965 – 970 and in the Special Provisions A88 and A99 primarily regarding the weight limitations for lithium batteries.

3.2 In this context it is particularly important to consider that such batteries e.g. for hybrid and electric cars per se are subjected to comprehensive tests to meet relevant regulations, and in addition to safe transportation must also provide at least 10 years of reliable mechanical and electrical street operation, not least for economic reasons (life of battery = life of vehicle).

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