



WORKING PAPER

**DANGEROUS GOODS PANEL (DGP)
WORKING GROUP OF THE WHOLE ON LITHIUM BATTERIES**

FIRST MEETING

Montréal, 6 to 10 February 2012

Agenda Item 1: Carry-over work from DGP/23

LITHIUM BATTERY EXCEPTIONS

(Presented by the Secretary)

SUMMARY

This paper invites the working group to consider the proposal presented at DGP/23 to reduce the quantities of lithium ion and lithium metal batteries which are excepted from most of the provisions of the Technical Instructions.

Action by the DGP-WG/LB: The DGP-WG/LB is invited to amend Packing Instruction 965 and 968 as presented in Appendix B to this working paper.

1. INTRODUCTION

1.1 DGP/23 was presented with a proposal to reduce the quantities of lithium ion and lithium metal batteries which are excepted from most of the provisions of the Technical Instructions. The panel agreed to revisit the proposal at this working group of the whole meeting. An extract from the DGP/23 report is presented in Appendix A to this working paper to facilitate discussion. The proposal is presented in Appendix B.

APPENDIX A

EXTRACT FROM THE DGP/23 REPORT: DISCUSSIONS ON REDUCING THE QUANTITIES OF LITHIUM BATTERIES PERMITTED IN SECTION II OF PACKING INSTRUCTIONS 965 AND 968

5.1.7 **Lithium Battery Standards (DGP/23-WP/72 Revised and DGP/32-IP/11)**

5.1.7.1 An amendment to the lithium battery requirements was proposed, based on concerns that the current requirements were not sufficient. Before presenting the proposal to the panel, representatives from the Federal Aviation Administration (FAA) Tech Center briefed the panel on test results related to lithium batteries. The following findings were presented:

- a) Small- and medium-scale propagation tests indicated that a single cell in thermal runaway could generate enough heat to cause adjacent cells to also go into thermal runaway. This propagation would consume all of the cells within the shipping package and also spread to adjacent packages.
- b) Halon 1301 would suppress open flames from lithium-ion cells in thermal runaway but would not stop the propagation from cell-to-cell. In the case of lithium metal cells, the Halon 1301 had no effect other than suppressing the spread of fire to adjacent materials.
- c) Package modification tests were conducted to investigate low-cost material alternatives to stop the propagation of thermal runaway should one cell fail. None were successful thus far. Chemical oxygen generator overpacks were shown to successfully contain a lithium-ion fire; however, they were not successful at containing a lithium metal fire.
- d) A risk model for freighter fire accidents caused by cargo compartment fire on freighter aircraft suggested that 6.2 accidents caused by cargo compartment fires would occur in the next 10 years, with 4.5 of those accidents related to lithium batteries. The model was based on United States' freighter aircraft accidents caused by fire in Class E cargo compartments. A significant increase in lithium battery shipments by air over the next ten years was projected.

5.1.7.2 The panel expressed its appreciation for information provided. The Deputy Director, Safety Standardization and Infrastructure of ICAO's Air Navigation Bureau described this work as an SMS-hazard identification issue that was an essential tool for addressing aviation safety issues. There were, however, some concerns with the study. Some felt the data and assumptions on which the risk model was based were not accurate in that a smaller percentage of batteries were actually shipped by air. A battery manufacturer representative reported that lithium metal batteries had a long shelf life and were therefore largely transported by sea. He also reported that industry statistics existed and could be provided to the panel. Others felt that although the actual numbers might not be precise, there was no doubt that there had been a proportionally large increase in the amount shipped by air and that this trend would likely continue.

5.1.7.3 Following the presentation, the proposal was presented. It was explained that the original intent of the proposal was to eliminate exceptions which currently existed for small lithium ion and lithium metal batteries. Eliminating the exceptions for lithium batteries contained or packed in equipment was not considered, as it was felt protection was provided by the equipment. Based on comments received from industry and other panel members, a modification to the proposal was made to allow for lower-risk shipments. This exception for very small batteries would recognize the significant role e-commerce played in the lithium battery and portable electronic industry while still eliminating many of the risks.

5.1.7.4 The justification for the proposal was based on the findings presented by the FAA Tech Center (see paragraph 5.1.7.1) as well as on many arguments made at previous panel and working group meetings. These included:

- a) Exceptions from the full regulations for lithium batteries did not seem justifiable considering that they were felt necessary for many other common less hazardous commodities such as paint and dry ice.
- b) Under the exceptions, the pilot was not provided information which he would be provided under the full regulations such as the quantity, location and the types of lithium batteries on board the aircraft. The unique properties of a lithium battery fire could affect a pilot's decision-making process in an emergency situation if he had this information. Emergency responders would also be in a better position to respond to an emergency situation once the aircraft had landed if they had this information.
- c) Training requirements for excepted batteries were less stringent than they were for fully-regulated batteries. A key element of the regulations essential to safety was therefore lost. This did not seem justifiable, considering that lithium batteries posed a more substantial risk than many other dangerous goods subject to the full training requirements.
- d) An operator acceptance check and inspection was not required for excepted batteries. This could increase the chances of a damaged package being transported.
- e) The excepted batteries did not require a hazard label. A lithium battery handling label was required, but its effectiveness was questioned:
 - 1) Shippers who were required to apply the handling label were not required to have dangerous goods training, reducing the likelihood of compliance.
 - 2) General cargo acceptance personnel were not required to read the handling label or inspect the package for damage.
 - 3) Emergency responders were trained to respond to hazard class labels and UN numbers on packages — this information was lost.

5.1.7.5 It was suggested that when the revised provisions for lithium batteries were developed for the 2009-2010 Edition of the Technical Instructions, which included provisions for small quantities of lithium batteries not being subject to all of the requirements of the Instructions, it could not be foreseen that some shippers of lithium batteries would take advantage of the provisions to facilitate the shipment of such items in bulk. Since no limit was placed on the number of packages containing lithium batteries, large quantities of excepted batteries were being consolidated in overpacks, pallets, in single unit load

devices, and in single aircraft cargo compartments. This increased the risk in a fire situation, regardless of whether the fire was initiated by the batteries themselves or by an outside source.

5.1.7.6 The proposer felt that by adopting the amendment, a significant amount of the risks would be eliminated. Training would be required for shippers transporting lithium batteries, operator acceptance checks for compliance prior to loading and stowage aboard an aircraft would be required, and pilots would be notified of the presence, location and quantity of lithium batteries aboard the aircraft. At the same time, the significant role e-commerce played in the lithium battery and portable electronic industries would be addressed by allowing for very small shipments of cells and batteries that occurred via Internet sales and service. It was recognized that there would be an impact on the shipping industry, but it was felt that the benefits to safety made this impact worthwhile. It was believed that the reduction in quantity would make the use of the reduced provisions non-cost effective, and shippers would therefore elect to ship their batteries as fully-regulated shipments. Although this might not be the ultimate solution, and further changes might be required in the future, it was felt that to err on the side of safety was appropriate. The approach would bring most lithium batteries into the regulated dangerous goods transportation system.

5.1.7.7 There was some support for the proposal. It was recognized that only the quantity limits changed; the regulatory structure was retained, and it more accurately reflected the original intent of the panel. It was essential that such items were notified to the pilot in command, and the proposal presented a good compromise between fully regulating all batteries and maintaining the current limits. The proposal was an evolution of the current requirements and reflected new understanding of how batteries moved by air.

5.1.7.8 Some members felt they could not give proper consideration to the proposal, as the modification was presented at a late stage making it impossible for them to seek necessary consultation within their States. The proposer explained that the modification was made to the original paper in an attempt to address industry concerns. Those concerns had been raised after the original paper was published. The Secretary noted that in the past, late papers were not uncommon at DGP and, while considering time restraints, every effort was made to consider these papers, especially if they addressed safety threats. This fact was recognized by the panel, but because this amendment would have a significant impact if it were adopted, consultation was deemed necessary.

5.1.7.9 A majority of members did not agree with the proposal for a number of reasons including:

- a) Although there had been incidents involving lithium batteries, it was suggested these were caused by shippers not complying with the existing requirements and not by a weakness in them.
- b) Much time and effort was devoted to ensuring the current requirements, which were developed for the 2009-2010 Edition of the Instructions, were sufficient. They represented a 66% reduction in the quantity limit per package for lithium ion batteries, a 90% reduction for lithium metal batteries and a new lithium battery handling label. It was felt that these reductions were sufficient to significantly reduce risk.
- c) A cornerstone of compliance was stability of regulations. In the three years since their introduction, shippers were now getting used to the provisions and to change now, without any definitive safety case, could not be justified. There would need to

be a huge re-education process. Questions were still being received from some shippers on the current requirements; to change them yet again would cause confusion, which could potentially impact safety.

- d) The proposal would not achieve its aim because the same number of batteries would still be shipped in bulk — although the quantity of batteries per package would be smaller, the number of packages would simply increase.
- e) If changes were made in haste, further changes might be necessary should all aspects not be adequately addressed.
- f) Shippers had expended considerable resources in their efforts to comply with the current requirements; increased costs could result in an increase of intentional non-compliances.
- g) There was no proof that increasing the requirements would result in an increase in safety.

5.1.7.10 The proposer agreed that maintaining stable regulations was important, but suggested this should not stop the panel from making changes if safety deficiencies were identified. Determining the risks associated with the transport of articles and devices such as lithium batteries was not as straight forward as was the case for substances and materials. Methodologies for risk determination of substances and materials had been well established for many years. Once the risk was determined, it was unlikely to change. With new articles and devices, market reaction and changes in technology could result in increased risks which the panel would need to react to. There were, however, new technologies which could be used to help better determine these risks. Test results could be used as a tool in efforts to be predictive rather than reactive. Waiting for an incident or an accident to happen before making changes was not an option.

5.1.7.11 Although the majority of panel members did not support the amendment proposed, there was a consensus that the whole subject of lithium batteries needed to be reviewed. One specific area which needed to be addressed was how to provide for details of packages containing small quantities of lithium batteries to appear on the notification to the pilot in command. This could not be done in a piecemeal fashion, and it was felt the best way of achieving this would be to hold a working group to consider all aspects of the subject. Accordingly, the panel agreed to schedule a working group in early 2012.

5.1.7.12 During the discussion on the proposal, it was reported that differences remained among operators in the interpretation of what their level of responsibility for excepted batteries was. This had been discussed at an earlier working group (DGP-WG/09), and the working group had confirmed that for excepted batteries, operators had no responsibility for an acceptance check or special handling of these consignments; shippers could consign unit load devices or pallets of packages containing lithium batteries; and freight forwarders could consolidate multiple consignments of packages of lithium batteries into a unit load device.

APPENDIX B

PROPOSED AMENDMENT TO PACKING INSTRUCTIONS 965 AND 968

Part 4
PACKING INSTRUCTIONS

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Editorial Note.— Amendments agreed at DGP/23 are indicated with redline and strikeout. Amendments proposed in this working paper are indicated with shaded text in addition to redline and strikeout.

Packing Instruction 965

Passenger and cargo aircraft for UN 3480

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See paragraph 3.2.31 of DGP/23-WP/3:

SECTION II

With the exception of Part 1:2.3 (Transport of dangerous goods by post), 7:4.4 (Reporting of dangerous goods accidents and incidents) and 8:1.1 (Provisions for dangerous goods carried by passengers or crew), lithium ion cells and batteries offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.

See paragraph 5.1.13 DGP/23-WP/102:

Cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).

Waste lithium batteries and lithium batteries being shipped for recycling or disposal are forbidden from air transport unless approved by the appropriate national authority of the State of Origin and the State of the Operator.

Lithium ion cells and batteries may be offered for transport if they meet the following:

See paragraph 1 of this working paper:

- 1) for lithium ion cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;
- 2) for lithium ion batteries, the Watt-hour rating is not more than 100 Wh;
~~the Watt-hour rating must be marked on the outside of the battery case except for those batteries manufactured before 1 January 2009;~~

See paragraph 5.1.13 DGP/23-WP/102:

- 3) ~~each cell or battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, sub-section 38.3. However, batteries and cells manufactured before 1 January 2014 conforming to a design type tested according to the requirements of the fifth revised edition of the UN *Manual of Tests and Criteria*, Part III, sub-section 38.3 may continue to be transported;~~

Note.— Batteries are subject to these this tests irrespective of whether the cells of which they are composed have been so tested.

- 2) cells and batteries must be manufactured under a quality management programme as described in 2:9.3.1 e).

General requirements

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).

See paragraph 1 of this working paper:

Contents	Package quantity (Section II)	
	Passenger	Cargo
Lithium ion cells and batteries	10 kg G	10 kg G

	Cells and batteries with not more than 2.7 Wh	Cells with not more than 20 Wh	Batteries with not more than 100 Wh
Quantities of cells / batteries allowed in a package	No limit	8 cells	2 batteries
Package weight	2.5 kg G	3.0 kg G	3.0 kg G

ADDITIONAL PACKING REQUIREMENTS

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery then placed in a strong outer packaging.
- Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- Each package must be capable of withstanding a 1.2 m drop test in any orientation without:
 - damage to cells or batteries contained therein;
 - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
 - release of contents.
- Each package must be labelled with a lithium battery handling label (Figure 5-31).
- Each consignment must be accompanied with a document with an indication that:
 - the package contains lithium ion cells or batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures must be followed in the event the package is damaged, to include inspection and repacking if necessary;
 - a telephone number for additional information; and

See paragraph 5.1.12 of DGP/23-WP/102:

- the words “lithium ion batteries”, ~~“not restricted”~~ and ~~“in compliance with Section II of PI965”~~ must be placed on the air waybill, when an air waybill is used.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

OUTER PACKAGINGS

Boxes	Drums	Jerricans
Strong outer packagings		

See paragraph 5.1.5 of DGP/23-WP/102:

OVERPACKS

When packages are placed in an overpack, the lithium battery handling label required by this packing instruction must either be clearly visible or the label must be affixed on the outside of the overpack and. The overpack must be marked with the word “Overpack”.

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Packing Instruction 968

Passenger and cargo aircraft for UN 3090

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See paragraph 3.2.31 of DGP/23-WP/3:

SECTION II

With the exception of Part 1:2.3 (Transport of dangerous goods by post), 7:4.4 (Reporting of dangerous goods accidents and incidents) and 8:1.1 (Provisions for dangerous goods carried by passengers or crew), lithium metal or lithium alloy cells and batteries offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.

See paragraph 5.1.13 of DGP/23-WP/102:

Cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).

Waste lithium batteries and lithium batteries being shipped for recycling or disposal are forbidden from air transport unless approved by the appropriate national authority of the State of Origin and the State of the Operator.

Lithium metal or lithium alloy cells and batteries may be offered for transport if they meet the following:

- 1) ~~for a lithium metal cell, the lithium content is not more than 1 g;~~
- 2) ~~for a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g;~~
- 3) ~~each cell or battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, sub-section 38.3. However, batteries and cells manufactured before 1 January 2014 conforming to a design type tested according to the requirements of the fifth revised edition of the UN Manual of Tests and Criteria, Part III, sub-section 38.3 may continue to be transported;~~

*Note.— Batteries are subject to ~~these~~ **this tests** irrespective of whether the cells of which they are composed have been so tested.*

- 2) cells and batteries must be manufactured under a quality management programme as described in 2:9.3.1 e).

General requirements

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).

See paragraph 1 of this working paper:

Contents	Package quantity (Section II)	
	Passenger	Cargo
Lithium metal cells and batteries	2.5 kg G	2.5 kg G

	Cells and batteries with a lithium metal content of not more than 0.3 g	Cells with a lithium metal content of not more than 1 g each	Batteries with a lithium metal content of not more than 2 g each
Quantities of cells / batteries allowed in a package	No limit	8 cells	2 batteries
Package weight	2.5 kg G	3.0 kg G	3.0 kg G

ADDITIONAL PACKING REQUIREMENTS

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery then placed in a strong outer packaging.
- Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.

- Each package must be capable of withstanding a 1.2 m drop test in any orientation without:
 - damage to cells or batteries contained therein;
 - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
 - release of contents.
- Each package must be labelled with a lithium battery handling label (Figure 5-31).
- Each consignment must be accompanied with a document with an indication that:
 - the package contains lithium metal cells or batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures must be followed in the event the package is damaged, to include inspection and repacking if necessary;
 - a telephone number for additional information; and

See paragraph 5.1.12 of DGP/23-WP/102:

- the words “lithium metal batteries”, ~~“not restricted”~~ and “in compliance with Section II of PI968” must be placed on the air waybill, when an air waybill is used.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

OUTER PACKAGINGS

Boxes

Drums

Jerricans

Strong outer packagings

See paragraph 5.1.5 of DGP/23-WP/102:

OVERPACKS

When packages are placed in an overpack, the lithium battery handling label required by this packing instruction must either be clearly visible or the label must be affixed on the outside of the overpack. and the overpack must be marked with the word “Overpack”.

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— END —