



WORKING PAPER

DANGEROUS GOODS PANEL (DGP)

TWENTY-FIFTH MEETING

Montréal, 19 to 30 October 2015

Agenda Item 5: Development of a comprehensive strategy to mitigate risks associated with the transport of lithium batteries including development of performance-based packaging standards and efforts to facilitate compliance

**STATE OF CHARGE REQUIREMENT
FOR LITHIUM ION BATTERY (UN 3480) SHIPMENTS**

(Presented by M. Rogers)

SUMMARY

This working paper proposes to add a state of charge (SOC) requirement for the shipment of **Lithium ion batteries** (UN 3480) by aircraft.

Action by the DGP-WG: The DGP is invited to consider adopting the revisions to Packing Instruction 965 as presented in the appendix to this working paper.

1. INTRODUCTION

1.1 At the second International Multidisciplinary Lithium Battery Transport Coordination Meeting (Cologne, Germany, 9 to 11 September 2014), a recommendation was made by the group to limit the State of Charge (SOC) of lithium ion cells to 30 per cent during transport (Recommendation 3/14). This recommendation was made as an interim measure to reduce the probability of propagation of thermal runaway between cells, based on testing conducted by the United States Federal Aviation Administration (FAA) at the William J. Hughes Technical Center in Atlantic City, New Jersey.

1.2 At the DGP Working Group of the Whole Meeting in Rio de Janeiro in October 2014 (DGP-WG/14, 20 to 24 October 2014), and again at the DGP Working Group Meeting in Montreal in April 2015 (DGP-WG/15, 27 April to 1 May 2015), The Rechargeable Battery Association (PRBA) presented information on the safety issues that could arise if lithium ion cells are discharged to a low SOC. According to information presented by PRBA, prolonged low voltage following cell discharge could lead to cell degradation and undesirable effects. A graph attached to the information paper presented at DGP-WG/15 showed voltage decay beginning at approximately 10 per cent SOC, and stated that a discharge rate of 2 per cent per month was typical (temperatures above 30°C could double that rate).

1.3 PRBA subsequently justified a limit of 55 per cent SOC due to a need to store cells after air transport for prolonged periods of time (greater than four to six months). The Technical Instructions, however, govern dangerous goods while in transport. It is the responsibility of the shipper and consignee to ensure that dangerous goods do not present a risk while in storage six months or more after transport has been completed. Furthermore, it would be inappropriate to permit a SOC that has been shown in testing to promote propagation of thermal runaway (55 per cent) during transport in order to reduce the risk to cells that had been stored for six months or more.

1.4 Based on the information presented by the FAA Technical Center and the recommendation of the second International Multidisciplinary Lithium Battery Transport Coordination Meeting, an upper limit of a 30 per cent SOC would reduce the probability of the propagation of thermal runaway in transport. Based on the information from PRBA that voltage decay begins around 10 per cent SOC and with a maximum discharge rate of 4 per cent per month, a lower SOC limit of 15 per cent would ensure that lithium ion cells remain above 10 per cent while in air transport.

2. ACTION BY THE DGP

2.1 The DGP is invited to adopt the revisions to Packing Instruction 965 as shown in the appendix to this working paper.

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APPENDIX

PROPOSED AMENDMENT TO PART 4 OF THE TECHNICAL INSTRUCTIONS

Part 4

PACKING INSTRUCTIONS

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Chapter 11

CLASS 9 — MISCELLANEOUS DANGEROUS GOODS

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Packing Instruction 965	
Passenger and cargo aircraft for UN 3480	
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IA. SECTION IA	
Each cell or battery must meet all the provisions of 2;9.3.	
1A.1 General requirements	
	<u>— Part 4;1 requirements must be met.</u>
	<u>— Lithium ion cells and batteries must be shipped at a state of charge (SOC) of no more than 30 per cent and no less than 15 per cent.</u>
...	
IB.1 General requirements	
	<u>— Cells and 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).</u>
	<u>— Lithium ion cells and batteries must be shipped at a state of charge (SOC) of no more than 30 per cent and no less than 15 per cent.</u>
...	
II.1 General requirements	
	<u>— Cells and 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).</u>
	<u>— Lithium ion cells and batteries must be shipped at a state of charge (SOC) of no more than 30 per cent and no less than 15 per cent.</u>
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