



**WORKING PAPER**

**DANGEROUS GOODS PANEL (DGP)**

**TWENTY-EIGHTH MEETING**

**Virtual, 15 to 19 November 2021**

**Agenda Item 4: Managing safety risks posed by the carriage of lithium batteries by air (Ref: Job Card DGP.003.03)**

**REDUCED STATE OF CHARGE NOT EXCEEDING 30 PER CENT FOR UN 3481 THROUGH PACKING INSTRUCTION 910 OF THE SUPPLEMENT**

(Presented by S. Schwartz)

**SUMMARY**

This working paper proposes to amend Packing Instruction 910 of the Supplement to the Technical Instructions to include UN 3481 — **Lithium ion batteries packed with equipment** and UN 3481 — **Lithium ion batteries contained in equipment** in the maximum state of charge (SOC) requirement now applied to UN 3480 — **Lithium ion batteries** and to require that all shipments containing low production run and prototype lithium ion batteries (UN 3480 and UN 3481) be offered for transport at the lowest practical SOC, but not exceeding 30 per cent.

**Action by the DGP:** The DGP-WG is invited to consider amendments as detailed in the appendix to this working paper.

**1. INTRODUCTION**

1.1 Packing Instruction 910 of the Supplement applies to low production run and prototype lithium batteries and cells that may not have met the UN 38.3 test criteria.

1.2 When the 30 per cent state of charge (SOC) requirement for UN 3480 — **Lithium ion batteries** was implemented in Packing Instruction 965 of the Technical Instructions, it was seen as a way to quickly and easily reduce the general risk they pose in air transport. The 30 per cent level was based on tests demonstrating significantly reduced risk from many cells and batteries offered for transport, but it was never accepted as providing a safe level for all cells and batteries. Some cells and batteries pose significant risk if they enter thermal runaway in air transport when shipped at 30 per cent SOC.

1.3 Thermal runaway propagation and explosive gas generation normally decreases as SOC is reduced, and therefore the DGP is invited to consider whether Packing Instruction 910 of the Supplement should be amended to require UN 3480 to be offered for transport at the lowest practical SOC, but no higher than 30 per cent.

1.4 It has been assumed that the equipment in UN 3481 — **Lithium ion batteries packed with equipment** and UN 3481 — **Lithium ion batteries contained in equipment** provides adequate protection from both thermal runaway propagation and explosive gas generation, but little data has been presented to demonstrate this. Additionally, battery energy density has been increasing and electronic component size (and presumably the protection it affords in the case of a battery failure) has been decreasing. It is therefore proposed to require UN 3481 shipped in accordance with Packing Instruction 910 be shipped at the lowest practical state of charge, but not to exceed 30 per cent.

1.5 Since there is no requirement that the lithium ion batteries and cells covered by Packing Instruction 910 of the Supplement be subjected to the UN 38.3 tests, further limiting the SOC in air transport would be an important safety enhancement to prevent propagation of thermal runaway, reduce the energy available to initiate a fire in the event of an internal short circuit, and limit the amount of explosive gas generated during a thermal runaway for both UN 3480 and UN 3481.

## 2. ACTION BY THE DGP

2.1 The DGP-WG is invited to consider amendments as detailed in the appendix to this working paper.

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APPENDIX

PROPOSED AMENDMENT TO PART S-4 OF THE SUPPLEMENT TO THE TECHNICAL  
INSTRUCTIONS

Part S-4

PACKING INSTRUCTIONS

(ADDITIONAL INFORMATION  
FOR PART 4 OF THE  
TECHNICAL INSTRUCTIONS)

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Chapter 11

CLASS 9 — MISCELLANEOUS DANGEROUS GOODS

Packing Instruction 910

Cargo aircraft only

**Introduction**

This instruction applies to UN Nos. 3090, 3091, 3480 and 3481 annual production runs consisting of not more than 100 cells or batteries and to pre-production prototypes of cells or batteries when these prototypes are transported for testing.

**General requirements**

Part 4, Chapter 1 requirements of the Technical Instructions must be met.

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Lithium ion cells and batteries (both UN 3480 and UN 3481) must be offered for transport at ~~a~~the lowest practical state of charge but not exceeding 30 per cent of their rated capacity unless a higher state of charge is specifically approved by the States of Origin and the State of the Operator.

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