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WORKING PAPER

DANGEROUS GOODS PANEL (DGP) WORKING GROUP MEETING (DGP-WG/24)

Montreal, 21 to 25 October 2024

Agenda Item 4: Managing safety risks posed by the carriage of lithium batteries by air (Ref: Job Card DGP.003.05)

GUIDANCE FOR ISSUING APPROVALS FOR THE TRANSPORT OF CELLS AND BATTERIES

(Presented by DGP-WG/Energy Storage Devices)

SUMMARY

This working paper seeks to provide an opportunity for the DGP-WG to consider further developing the guidance for issuing approvals for the transport of cells and batteries.

Action by the DGP-WG: Action by the DGP-WG is in paragraph 2.

1. INTRODUCTION

1.1 At the twenty-ninth meeting of the DGP (DGP/29, 13 to 17 November 2023) the panel agreed to extend an existing requirement for UN 3480 — **Lithium ion batteries** to be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity to UN 3481 — **Lithium ion batteries packed with equipment.** The panel also agreed to add a provision allowing for lithium ion batteries packed with equipment to be shipped at higher states of charge with the approval of the State of Origin and the State of the Operator under the written conditions established by those authorities.

1.2 During DGP/29 some panel members expressed concern that there would be a high number of requests for approval which might impact States and this could in turn impact the supply chain and the flow of goods. Industry representatives suggested an approval from the operator would be sufficient through their own safety risk assessment. However, panel members agreed oversight from the State of the Operator and the State of Origin is necessary and while sympathetic to the challenges, wanted to make sure that requests for approvals did not become a normal business practice. Additionally, States could also obtain valuable information through the approval process. There was an agreement that guidance on issuing approvals specifically for lithium batteries was necessary.

1.3 Following the Air Navigation Commission (ANC) review of the DGP/29 report, the ANC tasked the panel with developing guidance material to assist States in considering the granting of

approvals to transport lithium ion batteries at higher states of charge for incorporation in the 2025-2026 Edition of the Supplement. The ANC added this as a new task to ANC job card DGP.003.05: Mitigating safety risks posed by the carriage of lithium batteries by air. The energy storage devices working group (DGP-WG/ESD) completed an update of the Supplement and presented this material to the panel via correspondence.

1.4 During the process of updating the Supplement, DGP-WG/ESD members suggested various amendments to the guidance material. Many of these suggestions were incorporated into the revised guidance. However, some commenters raised additional topics that require further consideration and due to time constraints could not be adopted into the 2025-2026 Edition of the Supplement. Some of these suggestions would expand the scope of the guidance beyond issuing approvals to transport lithium batteries at higher states of charge and warrant further consideration by the panel.

1.5 Specific suggestions that require additional consideration include:

a) guidance to evaluate applications for approvals for single shipments, multiple shipments or approvals granted for an extended period;

b) expanding the guidance to delineate and identify the criteria that should be considered by the appropriate national authority depending on whether the authority is issuing an approval from the State of Origin, State of Operator, or State of Destination;

c) guidance on applying transport controls from previously-issued approvals to new approvals; and

d) expanding the scope of the guidance to include all instances in which prior approval is required. Such instances include transport of prototype and low production runs (Special Provision A88), batteries that exceed the 35 kg gross mass limit for transport by cargo only aircraft (Special Provision A99) and transport of lithium cell or batteries on passenger aircraft (Special Provision A201).

2. ACTION BY THE DGP-WG

2.1 The DGP-WG is invited to review the provisions contained in the appendix to this working paper, which are extracts from the 2025-2026 editions of the Technical Instructions and its Supplement, and convene a working group meeting to consider whether guidance to States needs to be further expanded.

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APPENDIX

EXTRACTS FROM THE TECHNICAL INSTRUCTIONS AND ITS SUPPLEMENT

PART S-1;4 OF THE SUPPLEMENT TO THE TECHNICAL INSTRUCTIONS:

Chapter 4

GUIDANCE TO STATES ON ISSUING APPROVALS AND EXEMPTIONS RELATED TO THE TRANSPORT OF LITHIUM BATTERIES AND SODIUM ION BATTERIES AS CARGO

4.1 INTRODUCTION

4.1.1 Lithium cells and batteries have the potential to enter thermal runaway, an irreversible exothermic chemical reaction within the cell causing an uncontrollable release of internal electrical and chemical energy resulting in a rapid and accelerating rise of temperature. Once one cell or battery experiences thermal runaway, it can generate enough heat to trigger thermal runaway in adjacent cells or batteries. Thermal runaway can occur for a number of reasons, including poor design, manufacturing flaws and external abuse. It has been demonstrated through testing that thermal runaway can result in fire and/or explosion.

4.1.2 A prohibition on the transport of UN 3090 – **Lithium metal batteries** as cargo on passenger aircraft was introduced into the 2015–2016 edition of the Technical Instructions with the knowledge that aircraft cargo fire protection systems could not control a lithium metal fire. Later test results demonstrated that a fire involving high-density packages of UN 3480 – **Lithium ion batteries** could exceed the capability of aircraft cargo fire protection systems. High-density packages of lithium ion batteries may consist of any number of batteries or cells having the potential to overwhelm cargo compartment fire protection features. The potential is dependent on a number of variables including the battery or cell chemistry, size, design type, quantities and the cargo compartment configuration. The inability to determine an absolute safe quantity limit for lithium ion batteries and the absence of a packaging standard to mitigate the risks led to the decision to introduce a prohibition on the transport of UN 3480 – **Lithium ion batteries** as cargo on passenger aircraft. This prohibition was extended to UN 3551 – **Sodium ion batteries** in the 2025–2026 edition of the Technical Instructions. Cells and batteries may only be transported on passenger aircraft with the prior approval of the authorities of the State of Origin, the State of the Operator and the State of Destination under the written conditions established by those authorities through Special Provision A201 of the Technical Instructions and A334 of this Supplement.

4.1.3 Cells and batteries at a reduced state of charge are less prone to thermal runaway and pose a lesser fire risk as compared to cells and batteries at higher states of charge. A reduced state of charge also makes thermal runaway less likely to propagate to other cells or batteries in either the same or different shipments and reduces the likelihood of fire, extreme heat and generation of flammable or toxic gases in the event of a thermal runaway. A requirement for UN 3480 – **Lithium ion batteries** to be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity was added to the 2015–2016 edition of the Technical Instructions for this reason. The requirement is extended to UN 3481 – **Lithium ion batteries packed with equipment** for cells or batteries with a Watt-hour rating exceeding 2.7 Wh from 1 January 2026. Cells and/or batteries at a state of charge exceeding 30 per cent of their rated capacity may only be offered for transport with the approval of the appropriate national authorities of the State of Origin and the State of the Operator under the written conditions established by those authorities in accordance with Special Provision A331 of this Supplement.

4.1.4 Appropriate national authorities should consider the general guidance in Part S-1;1 when processing exemptions or approvals. They should also consider the mitigating measures identified in the applicable special provisions and the following criteria, at a minimum, as part of a safety risk assessment to determine whether or not to grant an approval or an exemption to transport cells and batteries as cargo on a passenger aircraft or at states of charge exceeding 30 per cent:

a) capabilities of the operator;

b) overall capability of the aircraft and its systems;

c) mitigating effects of the packing method and packaging to include:

   1) density and proximity of cells and batteries to each other and other combustible material;

2) method of securement or, in the case of multiple batteries or items of equipment, separation of cell or batteries in the same package;

3) the presence or absence of inner packagings or cushioning material and its performance characteristics, such as non-combustible and not electrically conductive;

4) tests or modeling to demonstrate the ability of the packaging or overpack to contain the hazardous effects of a thermal runaway including heat, flame and gas emission;

d) quantity and energy capacity of cells and/or batteries per package or overpack;

e) containment characteristics of unit load devices and fire containment covers;

f) specific hazards and safety risks associated with each cell and/or battery type to be carried alone or with equipment;
g) chemical composition of the cells and/or batteries;

h) state of charge when offered for transport;

i) whether the approval is for an ongoing purpose, a single shipment or limited number of shipments;

j) assessments of the cells, batteries or consignments completed by other appropriate national authorities; and

k) approvals granted for similar shipments and transport conditions.

The specific criteria considered by the appropriate authorities of each State involved in the approval or exemption process may vary depending on what is relevant to the respective State.

SPECIAL PROVISION A331 FROM THE SUPPLEMENT TO THE TECHNICAL INSTRUCTIONS:

A331 a) Lithium ion or sodium ion cells and/or batteries (UN 3480 and UN 3551); and

b) Lithium ion batteries packed with equipment (UN 3481) with a Watt-hour rating in excess of 2.7 Wh;

may only be offered for transport at a state of charge exceeding 30 per cent of their rated capacity with the approval of the appropriate national authorities of the State of Origin and the State of the Operator under the written conditions established by those authorities. Lithium ion or sodium ion cells or batteries (UN 3480 and UN 3551) offered for transport at a state of charge exceeding 30 per cent of their rated capacity may only be transported on a cargo aircraft.

When considering an approval, at a minimum, the following criteria should be considered to mitigate risks posed by a lithium ion or sodium ion cell or battery heat, smoke or fire event inside a package at the cell, battery or package level:

a) no hazardous amount of flame is allowed outside the package;

b) the external surface temperature of the package cannot exceed the amount that would ignite adjacent packing material or cause batteries or cells in adjacent packages to go into thermal runaway;

c) no hazardous fragments can exit the package, and the package must maintain structural integrity; and

d) the quantity of flammable vapour emitted must be less than the amount of gas that when mixed with air and ignited could cause a pressure pulse that could dislodge the overpressure panels of the aircraft cargo compartment or damage the aircraft cargo compartment liners.

SPECIAL PROVISION A201 FROM THE TECHNICAL INSTRUCTIONS:

A201 In instances where other forms of transport (including cargo aircraft) are impracticable, lithium and sodium ion cells or batteries may be transported as Class 9 (UN 3480, UN 3090 or UN 3551) on passenger aircraft with the prior approval of the authority of the State of Origin, the State of the Operator and the State of Destination under the written conditions established by those authorities, provided that the quantities per package do not exceed:

a) for lithium metal cells or batteries:

1) up to 2 batteries with a lithium content more than 0.3 g but not more than 2 g per battery; or

2) up to 8 cells with a lithium content more than 0.3 g but not more than 1 g per cell; or

3) up to 2.5 kg of cells and/or batteries with a lithium content not more than 0.3 g per cell or battery; or

b) for lithium ion cells or batteries:

1) up to 2 batteries with a Watt-hour (Wh) rating more than 2.7 Wh but not more than 100 Wh per battery; or

2) up to 8 cells with a Watt-hour rating more than 2.7 Wh but not more than 20 Wh per cell; or

3) up to 2.5 kg of cells and/or batteries with a Watt-hour rating not more than 2.7 Wh per cell or battery; or

c) for sodium ion cells or batteries:

1) up to 2 batteries with a Watt-hour (Wh) rating more than 2.7 Wh but not more than 100 Wh per battery; or

2) up to 8 cells with a Watt-hour rating more than 2.7 Wh but not more than 20 Wh per cell; or

3) up to 2.5 kg of cells and/or batteries with a Watt-hour rating not more than 2.7 Wh per cell or battery.

In instances where other forms of transport (including cargo aircraft) are impracticable and in the case of urgent medical need, one consignment of lithium batteries may be transported as Class 9 (UN 3480 or UN 3090) on a passenger aircraft with the prior approval of the authority of the State of Origin and with the approval of the operator under the following conditions:

a) the shipper must provide a copy of the test summary report as specified in Part 2;9.3 g);

b) the consignment must not contain more than 4 batteries;

c) for lithium ion batteries:

1) the Watt-hour rating of each battery must not exceed 100 Wh; and

2) the batteries must be prepared in accordance with Packing Instruction 965, Section IA;

d) for lithium metal batteries:

1) the lithium content of each battery must not exceed 2 g; and

2) the batteries must be prepared in accordance with Packing Instruction 968, Section IA.

When States, other than the State of Origin, the State of the Operator or State of Destination have notified ICAO that they require prior approval of shipments made under this special provision, approval must also be obtained from these States, as appropriate.

The requirements of Part 5 for Class 9 (UN 3090 or UN 3480) lithium metal and lithium ion batteries apply. A copy of the document of approval including the quantity limitations must accompany the consignment. Transport in accordance with this special provision must be noted on the dangerous goods transport document.

If transport in accordance with this special provision is not possible, States concerned may grant an exemption from the prohibition to transport lithium metal or lithium ion batteries on passenger aircraft in accordance with Part 1;1.1.3.

Authorities issuing exemptions or approvals in accordance with this special provision must provide a copy to the Chief of the Cargo Safety Section within three months via email at CSS@icao.int, via facsimile at +1 514-954-6077 or via post to the following address:

Chief, Cargo Safety Section
International Civil Aviation Organization
###999 Robert-Bourassa Boulevard
Montréal, Quebec
CANADA H3C 5H7

Note.— Guidance for the processing of exemptions or approvals from the prohibition to transport lithium batteries may be found in Part S-1;4 and Table S-3-1, Special Provision A334 of the Supplement to the Technical Instructions.

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