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WORKING PAPER

DANGEROUS GOODS PANEL (DGP) WORKING GROUP MEETING (DGP-WG/25)

Delhi, India, 21 to 25 April 2025

Agenda Item 4: Managing safety risks posed by the carriage of energy storage devices by air *(Ref: Job Card DGP.003.05)*

HARMONIZATION OF PROVISIONS FOR LITHIUM-ION AND LITHIUM-POLYMER BATTERIES PACKED WITH OR CONTAINED IN EQUIPMENT UNDER SECTION I OF PACKING INSTRUCTIONS 966 AND 967

(Presented by N. Kumar)

SUMMARY

This working paper proposes standardizing the packing provisions for lithium-ion and lithium-polymer cells and batteries – whether packed with or contained in equipment – as outlined in Packing Instructions 966 and 967 of Section I in Part 4;11 of Technical Instructions.

The study recommends the inclusion of mandatory UN-specified outer packaging for both packing instructions in Section I, with the aim of ensuring consistency and enhancing safety in the transport of high-power lithium-ion and polymer cells and batteries.

By harmonizing these provisions, the paper advocates for improved protection and risk mitigation in the shipment of high-power lithium-ion or polymer cells or battery devices and equipment.

Action by the DGP-WG is in paragraph 2.

1. INTRODUCTION

1.1 In accordance with the current regulations outlined in Part 4 of the Technical Instructions, UN-specified packaging is required for the shipment described below, where the lithium-ion or polymer cell power exceeds 20 Wh, the lithium-ion or polymer battery power exceeds 100 Wh, or the weight exceeds the Section II limit for cargo aircraft:

UN 3481 – Lithium-ion batteries packed with equipment, Packing Instruction 966, Section I

I.2 **Additional requirements**

- Cells and batteries must be protected against short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- Cells and batteries must:
  - be placed in inner packagings that completely enclose the cell or battery, then placed in a packaging of a type shown below that meets the Packing Group II performance requirements, then placed with the equipment in a strong, rigid outer packaging; or
  - be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a packaging of a type shown below that meets the Packing Group II performance requirements.
- The equipment must be secured against movement within the outer packaging.
- The number of cells or batteries in each package must not exceed the number required for the equipment's operation, plus two spare sets. A "set" of cells or batteries is the number of individual cells or batteries that are required to power each piece of equipment.
- Batteries manufactured after 31 December 2011 must be marked with the Watt-hour rating on the outside case.

I.3 **Outer packagings**

Boxes	*Drums*	*Jerricans*
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

However, the requirement for UN-specified packaging does not apply to the same type of cells or batteries (Section I) when they are contained in equipment, as outlined below:

UN 3481 – Lithium-ion batteries contained in equipment, Packing Instruction 967, Section I

I.2 **Additional requirements**

- The equipment must be secured against movement within the outer packaging and must be equipped with an effective means of preventing accidental activation.
- Where multiple pieces of equipment are packed in the same outer packaging, each piece of equipment must be packed to prevent contact with other equipment.
- Each package must be capable of withstanding, without damage to the equipment contained therein and without any reduction of effectiveness, a force applied to the top surface equivalent to the total weight of identical packages stacked to a height of 3 m (including the test sample) for a duration of 24 hours. Large equipment that is offered for transport unpackaged or on pallets is not subject to the requirements for the 3 m stack test capability.

  Note.— Capability may be demonstrated by testing, assessment or experience.

- Batteries manufactured after 31 December 2011 must be marked with the Watt-hour rating on the outside case.

I.3 **Outer packagings**

Boxes	*Drums*	*Jerricans*
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	

Reconstituted wood
Steel

1.2 **Application of Section I** for Lithium ion or polymer cells (Packed with equipment) or battery equipment or devices (Lithium battery contained in Equipment) – If the power of lithium-ion or polymer cells exceeds 20 Wh, the power of lithium-ion or polymer batteries exceeds 100 Wh, or the battery or cells weight exceeds the limits specified in Section II for cargo aircraft, then Section I of the relevant packing instructions must apply. This provision (Section I) applies to all lithium ion or polymer cells or battery shipments of devices and equipment, regardless of whether they are packed with equipment or contained in equipment, as outlined above.

1.3 There is a discrepancy between the two packing instructions within **Section I**, as outlined above paragraph 1.3. The relaxation of UN packaging requirements introduces a risk of misdeclaration, where shippers may incorrectly classify shipments as **Lithium-ion batteries contained in equipment** instead of **Lithium-ion batteries packed with equipment**.

1.4 Acceptance is done through documentation only, so there is a possibility of it being overlooked by the operator's staff, such as during acceptance by the handling team or screening by the security personnel.

1.5 The shipment of high-power lithium-ion or polymer cells (greater than 20 Wh) or batteries (greater than 100 Wh), or shipments exceeding the Section II weight limit for cargo aircraft under the above-mentioned shipments, presents significant risks and could potentially lead to catastrophic accidents if not properly packed in the appropriate packaging.

1.6 Historical incidents have underscored the dangers associated with lithium batteries and electronic devices, particularly in the context of using high-power lithium-ion batteries for commercial air transportation. Notable past incidents and accidents are outlined below:

a) **South African Airlines Flight 295, November 28, 1987** – **Probable Cause:** The official report suggested that the presence of computer equipment, and more specifically, the lithium batteries contained in the computers, could have been the cause of the fire. It was suspected that the batteries may have exploded or spontaneously combusted, leading to the crash of the flight;

b) **Northwest Airlines Flight 0026, April 28, 1999** – The NTSB (The National Transportation Safety Board) USA investigation determined that the probable cause was damaged lithium batteries, which highlighted a significant fire hazard to air transportation;

c) **FedEx Flight 0004, August 7, 2004** – Probable Cause: Lithium batteries from the ULD;

d) **UPS Flight 1307, February 7, 2006** – The NTSB USA determined that the probable cause of the accident was an in-flight cargo fire, likely originating from within the cargo container. The contents revealed that several electronic devices, including laptops;

e) **UPS Flight 6, September 3, 2010 - Probable Cause:** The UAE GCAA report states that the fire originated in a section of the cargo containing a significant number of lithium batteries and other combustible materials. It further notes that the fire

escalated rapidly into a catastrophic uncontained blaze. Approximately 81,000 lithium batteries were transported in holds 5, 6, and 7, ultimately leading to the aircraft crash.

f) **Asiana Airlines Flight OZ-991, July 28, 2011: Probable Cause:** The Aviation and Railway Accident Investigation Board (ARAIB) determined that a fire started near the pallets containing dangerous goods. The flight carried 58 tons of cargo, including 90% standard goods such as semiconductors, mobile phones, LCDs, and LEDs. The remaining 10% included 400 kg of lithium batteries, paint, resin solutions, and other liquids.

g) **EgyptAir Flight MS 804, May 19, 2016: Probable Cause:** The French Bureau of Enquiry and Analysis for Civil Aviation Safety (BEA) stated that a fire likely occurred in the cockpit while the flight was cruising over the Mediterranean Sea. Although the cause of the fire was not identified, aviation experts suggest it may have been caused by a laptop computer.

These incidents underscore the critical need for proper handling and accurate declaration of lithium-ion battery shipments to ensure safety in air transportation.

1.7 Given the increasing prevalence of lithium-ion batteries in a wide range of electronic devices and equipment, it is strongly recommended that both **Packing Instructions 966 and 967 of Section I**, as outlined above, must specify the exclusive use of UN specified packaging.

1.8 It is proposed that the adoption of UN-specified packaging for the transport of high-power lithium-ion or polymer cells or battery shipments, whether contained in or packed with equipment, will promote uniformity across the industry, thereby enhancing the safety of their transportation. Furthermore, this approach will eliminate discrepancies between packing instructions and prevent shippers from mis-declaring or altering shipments.

2. ACTION BY THE DGP-WG

2.1 The DGP-WG is invited to consider requiring UN specified packaging for outer packaging in Packing Instructions 967, Section I.

— END —

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 967

Passenger and cargo aircraft for UN 3481 (contained in equipment) only

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I.2 **Additional requirements**

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— Where multiple pieces of equipment are packed in the same outer packaging, each piece of equipment must be packed to prevent contact with other equipment.
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Note.— Capability may be demonstrated by testing, assessment or experience.

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Packing Instruction 967

I.3 **Outer packagings**

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Steel (4A)		

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— END —