International Civil Aviation Organization

DGP-WG/23-WP/14
14/4/23

WORKING PAPER

DANGEROUS GOODS PANEL (DGP) WORKING GROUP MEETING (DGP-WG/23)

Rio de Janeiro, Brazil, 15 to 19 May 2023

Agenda Item 1: Harmonizing ICAO dangerous goods provisions with UN Recommendations on the Transport of Dangerous Goods (REC-A-DGS-2025)

1.2: Develop proposals, if necessary, for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2025-2026 Edition

DRAFT AMENDMENTS TO PART 4 OF THE TECHNICAL INSTRUCTIONS TO ALIGN WITH THE UN RECOMMENDATIONS

(Presented by the DGP Working Group on UN Harmonization)

SUMMARY

This working paper contains draft amendments to Part 4 of the Technical Instructions to reflect the decisions taken by the UN Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals at its ninth session (Geneva, 9 December 2022).

Action by the DGP-WG: The DGP-WG is invited to agree to the draft amendments in this working paper.

Part 4

PACKING INSTRUCTIONS

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Chapter 4

CLASS 2 — GASES

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4.1 SPECIAL PACKING PROVISIONS FOR DANGEROUS GOODS OF CLASS 2

4.1.1 General requirements

4.1.1.1 This section provides general requirements applicable to the use of cylinders and closed cryogenic receptacles for the transport of Class 2 gases (e.g. UN 1072 **Oxygen, compressed**). Cylinders and closed cryogenic receptacles must be constructed and closed so as to prevent any loss of contents which might be caused under normal conditions of transport, including by vibration, or by changes in temperature, humidity or pressure (resulting from change in altitude, for example).

UN Model Regulations, Chapter 4.1, 4.1.6.1.2 (see ST/SG/AC.10/50/Add.1)

4.1.1.2 Parts of cylinders and closed cryogenic receptacles that are in direct contact with dangerous goods must not be affected or weakened by those dangerous goods and must not cause a dangerous effect (e.g. catalysing a reaction or reacting with the dangerous goods). In addition to the requirements specified in the relevant packing instruction, which take precedence, the applicable provisions of ISO ~~11114-1:2012 + A1:2017~~ 11114-1:2020 and ISO ~~11114-2:2013~~ 11114-2:2021 must be met.

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UN Model Regulations, Chapter 4.1, 4.1.6.1.8 (see ST/SG/AC.10/50/Add.1)

4.1.1.8 Valves must be designed and constructed in such a way that they are inherently able to withstand damage without release of the contents or must be protected from damage, which could cause inadvertent release of the contents of the cylinder and closed cryogenic receptacle, by one of the following methods:

a) Valves are placed inside the neck of the cylinder and closed cryogenic receptacle and protected by a threaded plug or cap;

b) Valves are protected by caps or guards. Caps must possess vent holes of a sufficient cross-sectional area to evacuate the gas if leakage occurs at the valves;

c) Valves are protected by shrouds or ~~guards~~ permanent protective attachments;

d) Not used; or

e) Cylinders and closed cryogenic receptacles are transported in an outer packaging. The packaging as prepared for transport must be capable of meeting the drop test specified in 6;4.3 at the Packing Group I performance level.

For cylinders and closed cryogenic receptacles with valves as described in b) ~~and c)~~, the requirements of ISO 11117:1998, ISO 11117:2008 + Cor 1:2009 or ISO 11117:2019 must be met~~;~~. Requirements for shrouds and permanent protective attachments used as valve protection under c) are given in the relevant pressure receptacle shell design standards, see 6;5.2.1. ~~for~~ ~~v~~Valves with inherent protection used for refillable cylinders must meet~~,~~ the requirements of ~~Annex A~~ clause 4.6.2 of ISO 10297:2006~~, Annex A~~ or clause 5.5.2 of ISO 10297:2014 ~~or Annex A of ISO 1029~~ or clause 5.5.2 of ISO 10297:2014 + Amd 1:2017 ~~must be met. For cylinders and closed cryogenic receptacles with~~ or, in the case of self-closing valves, of clause 5.4.2 of ISO 17879:2017. For valves with inherent protection used for non-refillable cylinders, the requirements of ~~Annex A~~ clause 9.2.5 ~~of ISO 17879:2017 must be met For metal hydride storage systems, the valve protection requirements specified in ISO 16111:2008 or ISO 16111:2018~~ of ISO 11118:2015 or of clause 9.2.5 of ISO 11118:2015 + Amd 1:2019 must be met.

4.2 PACKING INSTRUCTIONS

Packing Instruction 200

For cylinders, the general packing requirements of 4;1.1 and 4;4.1.1 must be met.

Cylinders, constructed as specified in 6;5 are authorized for the transport of a specific substance when specified in the following tables (Table 1 and Table 2). Cylinders other than UN marked and certified cylinders may be used if the design, construction, testing, approval and marks conform to the requirements of the appropriate national authority in which they are approved and filled. The substances contained must be permitted in cylinders and permitted for air transport according to these Instructions. Cylinders for which prescribed periodic tests have become due must not be charged and offered for transport until such retests have been successfully completed. Valves must be suitably protected or must be designed and constructed in such a manner that they are able to withstand damage without leakage as specified in Annex B of ISO 10297:1999. Cylinders with capacities of one litre or less must be packaged in outer packaging constructed of suitable material of adequate strength and design in relation to the packaging capacity and its intended use, and secured or cushioned so as to prevent significant movement within the outer packaging during normal conditions of transport. For some substances, the special packing provisions may prohibit a particular type of cylinder. The following requirements must be met:

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UN Model Regulations, Chapter 4.1, 4.1.4.1, P200 (4) (see ST/SG/AC.10/50/Add.1)

5) The filling of cylinders must be carried out by qualified staff using appropriate equipment and procedures. The procedures should include checks of:

—a) the conformity of cylinders and accessories with these Instructions;
—b) their compatibility with the product to be transported;
—c) the absence of damage which might affect safety;
—d) compliance with the degree or pressure of filling, as appropriate;
—e) marks and identification.

These requirements are deemed to be met if the following standards are applied:

ISO 10691: 2004 Gas cylinders — Refillable welded steel cylinders for liquefied petroleum gas (LPG) — Procedures for checking before, during and after filling.
ISO 11372: 2011 Gas cylinders — Acetylene cylinders — Filling conditions and filling inspection
ISO 11755: 2005 Gas cylinders — Cylinder bundles for compressed and liquefied gases (excluding acetylene) — Inspection at time of filling
ISO 13088: 2011 +AMD. 1:2020 Gas cylinders — Acetylene cylinder bundles — Filling conditions and filling inspection
ISO 24431:2016 Gas cylinders — Seamless, welded and composite cylinders for compressed and liquefied gases (excluding acetylene) — Inspection at time of filling

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6) “Special packing provisions”:

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Gas specific provisions:

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UN Model Regulations, Chapter 4.1, 4.1.4.1, P200 (5) (see ST/SG/AC.10/50/Add.1)

s) Aluminium alloy cylinders must be:

—a) Equipped only with brass or stainless steel valves; and
—b) Cleaned in accordance with ISO 11621:1997 and not contaminated with oil.

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Table 2. LIQUEFIED GASES AND DISSOLVED GASES

UN No.	Name and description	Class or Division	Subsidiary hazard	LC_{50} ml/m^3	Cylinders	Test period, years	Test pressure, bar	Filling ratio	Special packing provisions
1001	**Acetylene, dissolved**	2.1			X	10	60 52		c, p
1009	**Bromotrifluoromethane (refrigerant gas R 13b1)**	2.2			X	10	42 120 250	1.13 1.44 1.60	
1010	**Butadienes, stabilized** (1,2-butadiene)	2.1			X	10	10	0.59	
1010	**Butadienes, stabilized** (1,3-butadiene)	2.1			X	10	10	0.55	z

UN Model Regulations, Chapter 4.1, 4.1.4.1, P200 Table 2 (see ST/SG/AC.10/50/Add.1)

1010	**Butadienes and hydrocarbon mixture, stabilized** containing more than ~~40%~~ 20% butadienes	2.1			X	10			v z

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Packing Instruction 202

This instruction applies to Class 2 refrigerated liquefied gases in open and closed cryogenic receptacles.

Requirements for closed cryogenic receptacles

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UN Model Regulations, Chapter 4.1, 4.1.4.1, P203 (5) (see ST/SG/AC.10/50/Add.1)

5) ~~Degree of f~~Filling

For non-flammable, non-toxic refrigerated liquefied gases, the volume of liquid phase at the filling temperature and at a pressure of 100 kPa (1 bar) must not exceed 98 per cent of the water capacity of the pressure receptacle.

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Requirements for open cryogenic receptacles

Open cryogenic receptacles must be constructed to meet the following requirements:

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Packing Instruction 202

UN Model Regulations, Chapter 4.1, 4.1.4.1, P203 (9) (see ST/SG/AC.10/50/Add.1)

9. Open cryogenic receptacles must bear the following marks permanently affixed, e.g. by stamping, engraving or etching:

—a) the manufacturer's name and address;
—b) the model number or name;
—c) the serial or batch number;
—d) the UN number and proper shipping name of gases for which the receptacle is intended;
—e) the capacity of the receptacle in litres.

Note.— The size of the mark must be as set out for cylinders in Part 6;5.2.7.1. Open cryogenic receptacles manufactured prior to 1 January 2012 are not required to be so marked.

10. Open cryogenic receptacles are permitted for nitrogen, argon, krypton, neon and xenon refrigerated liquids.

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Packing Instruction 218

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ADDITIONAL PACKING REQUIREMENTS

a) Cylinders must be so filled that at 50°C the non-gaseous phase does not exceed 95% of their water capacity, and they are not completely filled at 60°C. When filled, the internal pressure at 65°C must not exceed the test pressure of the cylinders. The vapour pressures and volumetric expansion of all substances in the cylinders must be taken into account.
b) Spray application equipment (such as a hose and wand assembly) must not be connected during transport.
c) The minimum test pressure must be in accordance with Packing Instruction 200 for the propellant but must not be less than 20 bar.

UN Model Regulations, Chapter 4.1, 4.1.4.1, P206 (PP89) (4) (see ST/SG/AC.10/50/Add.1)

d) Non-refillable cylinders used may have a water capacity in litres not exceeding 1 000 litres divided by the test pressure expressed in bars provided capacity and pressure restrictions of the construction standard comply with clause 1 of ISO 11118:~~1999~~2015 + Amd 1:2019, which limits the maximum capacity to 50 litres.
e) For liquids charged with a compressed gas, both components — the liquid and the compressed gas — have to be taken into consideration in the calculation of the internal pressure in the cylinder. When experimental data is not available, the following steps must be carried out:

i) Calculation of the vapour pressure of the liquid and of the partial pressure of the compressed gas at 15°C (filling temperature);

ii) Calculation of the volumetric expansion of the liquid phase resulting from the heating from 15°C to 65°C and calculation of the remaining volume for the gaseous phase;

iii) Calculation of the partial pressure of the compressed gas at 65°C considering the volumetric expansion of the liquid phase;

Note.— The compressibility factor of the compressed gas at 15°C and 65°C must be considered.

iv) Calculation of the vapour pressure of the liquid at 65°C;

v) Calculation of the total pressure, which is the sum of the vapour pressure of the liquid and the partial pressure of the compressed gas at 65°C;

vi) Consideration of the solubility of the compressed gas at 65°C in the liquid phase.

The test pressure of the cylinders must not be less than the calculated total pressure minus 100 kPa (1 bar).

If the solubility of the compressed gas in the liquid phase is not known for the calculation, the test pressure can be calculated without taking the gas solubility (sub-paragraph vi)) into account.

f) For fire extinguishing agents assigned to UN 3500, the maximum test period for periodic inspection must be ten years.

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Chapter 5

CLASS 3 — FLAMMABLE LIQUIDS

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Packing Instruction 372

Cargo aircraft only for UN 3165 only

UN Model Regulations, Chapter 4.1, 4.1.4.1, P301 (see ST/SG/AC.10/50/Add.1)

General requirements

The requirements of Part 4~~, Chapter 1 requirements~~;1.1.1, 4;1.1.5; 4;1.1.8 and 4;1.1.10 must be met~~, including:~~.

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

~~2) **Closure requirements**~~

~~— Closures must meet the requirements of 4;1.1.4.~~

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Chapter 6

CLASS 4 — FLAMMABLE SOLIDS; SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION; SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES

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Packing Instruction 492

Passenger and cargo aircraft for UN 3292 only

General requirements

Part 4, Chapter 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN Model Regulations, Chapter 3.2, dangerous goods list (see ST/SG/AC.10/50/Add.1):

UN number and proper shipping name	*Packing conditions*	*Total quantity per package — passenger*	*Total quantity per package — cargo*
UN 3292 **Batteries, containing metallic sodium or sodium alloy**	Batteries may be offered for transport and transported unpacked or in protective enclosures such as fully enclosed or wooden slatted crates that are not subject to the requirements of Part 6 of these Instructions.	Forbidden	No limit
UN 3292 **Cells, containing metallic sodium or sodium alloy**	There must be sufficient cushioning material to prevent contact between cells and between cells and the internal surfaces of the outer packaging and to ensure that no dangerous movement of the cells within the outer packaging occurs in transport.	25 kg	400 kg

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Chapter 8

CLASS 6 — TOXIC AND INFECTIOUS SUBSTANCES

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Packing Instruction 650

This packing instruction applies to UN 3373.

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UN Model Regulations, Chapter 4.1, 4.1.4.1, P650 (6) (see ST/SG/AC.10/50/Add.1)

6) The completed package must be capable of ~~successfully passing the drop test in 6;6.5.3 as specified in 6;6.5.2 of the Instructions except that the height of the drop must not be less than 1.2 m. Following the appropriate drop sequence, there must be no~~ withstanding a 1.2 m drop in any orientation without leakage from the primary receptacle(s), which must remain protected by absorbent material, when required, in the secondary packaging.

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

7) For liquid substances:

a) The primary receptacle(s) must be leakproof and must not contain more than 1 litre;

b) The secondary packaging must be leakproof;

c) If multiple fragile primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated to prevent contact between them;

d) Absorbent material must be placed between the primary receptacle(s) and the secondary packaging. The absorbent material must be in quantity sufficient to absorb the entire contents of the primary receptacle(s) so that any release of the liquid substance will not compromise the integrity of the cushioning material or of the outer packaging;~~.~~

e) The primary receptacle or the secondary packaging must be capable of withstanding, without leakage, an internal pressure of 95 kPa (0.95 bar); and

UN Model Regulations, Chapter 4.1, 4.1.4.1, P650 (7) (see ST/SG/AC.10/50/Add.1)

DGP-WG/UN Harmonization proposes that the new text in square brackets added to the UN Model Regulations is not needed for the Instructions because of the existing note in the Instructions (which incorrectly appeared under f) and therefore moved here).

Note.— [Capability may be demonstrated by testing, assessment or experience.] The capability of a packaging to withstand an internal pressure without leakage that produces the specified pressure differential should be determined by testing samples of primary receptacles or secondary packagings. Pressure differential is the difference between the pressure exerted on the inside of the receptacle or packaging and the pressure on the outside. The appropriate test method should be selected based on receptacle or packaging type. Acceptable test methods include any method that produces the required pressure differential between the inside and outside of a primary receptacle or a secondary packaging. The test may be conducted using internal hydraulic or pneumatic pressure (gauge) or external vacuum test methods. Internal hydraulic or pneumatic pressure can be applied in most cases as the required pressure differential can be achieved under most circumstances. An external vacuum test is not acceptable if the specified pressure differential is not achieved and maintained. The external vacuum test is a generally acceptable method for rigid receptacles and packagings but is not normally acceptable for:

— flexible receptacles and flexible packagings;
— receptacles and packagings filled and closed under an absolute atmospheric pressure lower than 95 kPa.

f) The outer packaging must not contain more than 4 litres. This quantity excludes ice, dry ice or liquid nitrogen when used to keep specimens cold.

~~*Note.— The capability of a packaging to withstand an internal pressure without leakage that produces the specified pressure differential should be determined by testing samples of primary receptacles or secondary packagings. Pressure differential is the difference between the pressure exerted on the inside of the receptacle or packaging and the pressure on the outside. The appropriate test method should be selected based on receptacle or packaging type. Acceptable test methods include any method that produces the required pressure differential between the inside and outside of a primary receptacle or a secondary packaging. The test may be conducted using internal hydraulic or pneumatic pressure (gauge) or external vacuum test methods. Internal hydraulic or pneumatic pressure can be applied in most cases as the required pressure differential can be achieved under most circumstances. An external vacuum test is not acceptable if the specified pressure differential is not achieved and maintained. The external vacuum test is a generally acceptable method for rigid receptacles and packagings but is not normally acceptable for:*~~

~~*— flexible receptacles and flexible packagings;*~~

~~*— receptacles and packagings filled and closed under an absolute atmospheric pressure lower than 95 kPa.*~~

8) For solid substances:

   a) The primary receptacle(s) must be siftproof and must not exceed the outer packaging mass limit;

   b) The secondary packaging must be siftproof;

   c) If multiple fragile primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated to prevent contact between them;

   d) Except for packages containing body parts, organs or whole bodies, the outer packaging must not contain more than 4 kg. This quantity excludes ice, dry ice or liquid nitrogen when used to keep specimens cold; and

   e) If there is any doubt as to whether or not residual liquid may be present in the primary receptacle during transport, then a packaging suitable for liquids, including absorbent materials, must be used.

9) Refrigerated or frozen specimens: ice, dry ice and liquid nitrogen:

   a) When dry ice or liquid nitrogen is used to keep specimens cold, all applicable requirements of these Instructions must be met. When used, ice or dry ice must be placed outside the secondary packagings or in the outer packaging or an overpack. Interior supports must be provided to secure the secondary packagings in the original position after the ice or dry ice has dissipated. If ice is used, the outside packaging or overpack must be leakproof. If carbon dioxide, solid (dry ice) is used, the packaging must be designed and constructed to permit the release of carbon dioxide gas to prevent a build-up of pressure that could rupture the packagings; and

   b) The primary receptacle and the secondary packaging must maintain their integrity at the temperature of the refrigerant used as well as the temperatures and the pressures which could result if refrigeration were lost.

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Chapter 10

CLASS 8 — CORROSIVE SUBSTANCES

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Packing Instruction 866

Cargo aircraft only for UN 2028 only

General requirements

Part 4, Chapter 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
UN number and proper shipping name		*Packing conditions*	*Total quantity per package — passenger*	*Total quantity per package — cargo*	
UN 2028	**Bombs, smoke, non-explosive** with corrosive liquid, without initiating device	Bombs, smoke may be carried provided they are without ignition elements, bursting charges, detonating fuses or other explosive components.	Forbidden	50 kg	No

UN Model Regulations, Chapter 4.1, 4.1.4.1, P803 (7) (see ST/SG/AC.10/50/Add.1)

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Packagings must meet the Packing Group II performance requirements.
— The articles must be individually packaged and separated from each other using partitions, dividers, inner packagings or cushioning material.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

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

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UN Model Regulations, Chapter 4.1, 4.1.4.1, P003 (see ST/SG/AC.10/50/Add.1)

Packing Instruction 869

Passenger and cargo aircraft for UN Nos. 3506 and 3554 only

General requirements

Part 4, Chapter 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS			SINGLE PACKAGINGS
UN number and proper shipping name	*Net quantity* per package — passenger*	*Net quantity* per package — cargo*	
UN 3506 **Mercury contained in manufactured articles** UN 3554 **Gallium contained in manufactured articles**	No limit	No limit	No

*For the purposes of Part 5;4.1.5.1 the "net quantity" shown on the dangerous goods transport document is the net mass of the manufactured articles in each package.

ADDITIONAL PACKING REQUIREMENTS

— Manufactured articles or apparatuses of which metallic mercury or gallium is a component part, such as manometers, pumps, thermometers, and switches must be packed in sealed inner liners or bags of strong leakproof and puncture-resistant material impervious to mercury which will prevent the escape of mercury or gallium from the package irrespective of its position before being packed in outer packagings.

Note.— Mercury switches and relays are excepted from the requirement for a sealed inner liner or bag providing they are of the totally enclosed leakproof type in sealed metal or plastic units.

— Electron tubes, mercury vapour tubes (tubes with less than a total net quantity of 450 g of mercury) must be packed in strong outer packagings with all seams and joints sealed with self-adhesive, pressure-sensitive tape which will prevent the escape of mercury from the package.

Note.— Tubes with 450 g of mercury or more must be packaged according to the requirements for manufactured articles or apparatuses (above).

— Electron tubes which are packed in sealed leakproof metal cases may be shipped in the manufacturer's original packagings.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes *Drums* *Jerricans*

Strong outer packagings

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Chapter 11

CLASS 9 — MISCELLANEOUS DANGEROUS GOODS

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Packing Instruction 952

UN Model Regulations, Chapter 3.2, dangerous goods list (see ST/SG/AC.10/50/Add.1):

Passenger and cargo aircraft for UN Nos. 3171, 3556, 3557 and 3558 only
(See Packing Instruction 220 for flammable gas-powered engines and machinery, Packing Instruction 378 for flammable liquid-powered engines and machinery, Packing Instruction 950 for flammable liquid-powered vehicles, Packing Instruction 951 for flammable gas-powered vehicles or Packing Instruction 972 for engines or machinery containing only environmentally hazardous fuels)

General requirements

Part 4, Chapter 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Quantity — passenger*	*Quantity — cargo*
UN 3171- **Battery-powered equipment** or **Battery-powered vehicle** UN 3556 **Vehicle, lithium ion battery powered** UN 3557 **Vehicle, lithium metal battery powered** UN 3558 **Vehicle, sodium ion battery powered**	No limit	No limit

DGP-WG/22 (see paragraph 4.2.2.3 of the DGP-WG/22 report) and UN Model Regulations, Chapter 3.2, dangerous goods list (see ST/SG/AC.10/50/Add.1):

ADDITIONAL PACKING REQUIREMENTS

This entry applies to vehicles and equipment, including machinery which are powered by wet batteries, metallic sodium batteries ~~or~~, lithium batteries or sodium ion batteries and which are transported with these batteries installed. Examples of such vehicles and equipment are electrically-powered cars, lawn mowers, wheelchairs and other mobility aids. Vehicles that also contain an internal combustion engine must be consigned under the entry UN 3166 Vehicle (flammable gas powered) (See Packing Instruction 951) or Vehicle (flammable liquid powered) (See Packing Instruction 950), as appropriate.

Where vehicles or equipment could possibly be handled in other than an upright position, the vehicle or equipment must be secured in a strong, rigid outer packaging of the type below. The vehicle or equipment must be secured and restrained in the outer packaging to prevent any movement during transport which could change the orientation or cause the vehicle or equipment to be damaged. ~~The vehicle must be secured by means capable of restraining the vehicle in the outer packaging to prevent any movement during transport which would change the orientation or cause the vehicle to be damaged.~~

Battery-powered vehicles~~, machines~~ or equipment must meet the following requirements:

Batteries

All batteries must be installed and securely fastened in the battery holder of the vehicle, machine or equipment and must be protected in such a manner so as to prevent damage and short circuits. In addition:

1) If spillable batteries are installed, and it is possible for the vehicle~~, machine~~ or equipment to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction ~~492 or~~ 870 ~~as applicable~~.

2) If lithium batteries or sodium ion batteries are installed:

i) ~~lithium~~ batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport; and

ii) lithium batteries must meet the provisions of Part 2;9.3 and sodium ion batteries must meet the provisions of Part 2;9.4, unless otherwise approved by the appropriate authority of the State of Origin, except that pre-production prototypes of lithium or sodium ion batteries or cells, when these prototypes are transported for testing, or low production runs of lithium or sodium ion batteries or cells that have not been tested to the requirements in Part III, subsection 38.3 of the UN *Manual of Tests and Criteria* may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the State of the Operator. A copy of the document of approval must accompany the consignment.

iii) ~~W~~where the ~~lithium~~ battery is removed from the vehicle and is packed separate from the vehicle in the same outer packaging, the package must be consigned as UN 3481— **Lithium ion batteries packed with equipment**, UN 3552 — **Sodium ion batteries packed with equipment** or UN 3091 — **Lithium metal batteries packed with equipment** and packed according to Packing Instruction 966 or 969, as applicable.

3) If metallic sodium or sodium alloy batteries are installed, they must conform to the requirements of Special Provision A94.

Other operational equipment

1) Dangerous goods required for the operation or safety of the vehicle~~, machine~~ or equipment, such as fire extinguishers, tire inflation canisters or safety devices, must be securely mounted in the vehicle, machine or equipment. Aircraft may also contain other articles and substances which would otherwise be classified as dangerous goods but which are installed in that aircraft in accordance with the pertinent airworthiness requirements and operating regulations. If fitted, life-rafts, emergency escape slides and other inflation devices must be protected such that they cannot be activated accidentally. Vehicles or equipment containing dangerous goods identified in Table 3-1 as forbidden on passenger aircraft may only be transported on cargo aircraft. Replacements for the dangerous goods permitted must not be carried under this packing instruction.

2) Vehicles equipped with theft-protection devices, installed radio communications equipment or navigational systems must have such devices, equipment or systems disabled.

Strong outer packagings — vehicles and equipment

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

Packing Instruction 955

Passenger and cargo aircraft for UN 2990 and UN 3072 only

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ADDITIONAL PACKING REQUIREMENTS

Life-saving appliances may only contain the dangerous goods listed below:

a) Division 2.2 gases, must be contained in cylinders which conform to the requirements of the appropriate national authority of the country in which they are approved and filled. Such cylinders may be connected to the life-saving appliance. These cylinders may include installed actuating cartridges (cartridges, power device of Division 1.4C and 1.4S) provided the aggregate quantity of deflagrating (propellant) explosives does not exceed 3.2 grams per unit. When the cylinders are shipped separately, they must be classified as appropriate for the Division 2.2 gas contained and need not be marked, labelled or described as explosive articles;

b) signal devices (Class 1), which may include smoke and illumination signal flares; signal devices must be packed in plastic or fibreboard inner packagings;

c) small quantities of flammable substances, corrosive solids and organic peroxides (Class 3, Class 8, Division 4.1 and 5.2), which may include a repair kit and not more than 30 strike-anywhere matches. The organic peroxide may only be a component of a repair kit and the kit must be packed in strong inner packaging. The strike-anywhere matches must be packed in a cylindrical metal or composition packaging with a screw-type closure and be cushioned to prevent movement;

d) electric storage batteries (Class 8), which must be disconnected or electrically isolated and protected against short circuits;

UN Model Regulations, Chapter 3.2, dangerous goods list (see ST/SG/AC.10/50/Add.1):

e) lithium batteries and sodium ion batteries:

1) identified as damaged or defective in accordance with Special Provision A154 are forbidden for transport;

2) must meet the applicable requirements of 2;9.3 or 2;9.4, as applicable;

3) must be disconnected or electrically isolated and protected against short circuits; and

4) must be secured against movement within the appliance.

f) first aid kits which may include flammable, corrosive and toxic articles or substances.

The appliances must be packed, so that they cannot be accidentally activated, in strong outer packagings and, except for life vests, the dangerous goods must be in inner packagings packed so as to prevent movement. The dangerous goods must be an integral part of the appliance without which it would not be operational and in quantities which do not exceed those appropriate for the actual appliance when in use.

Life-saving appliances may also include articles and substances not subject to these Instructions which are an integral part of the appliance.

UN Model Regulations, Chapter 3.2, dangerous goods list (see ST/SG/AC.10/50/Add.1):

Packing Instruction 961

Passenger and cargo aircraft for UN Nos. 3268 and 3559 only

General requirements

Part 4, Chapter 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Quantity — passenger*	*Quantity — cargo*	**SINGLE PACKAGINGS**
UN 3268 **Safety devices**, electrically initiated UN 3559 **Fire suppressant dispersing devices**	25 kg	100 kg	No

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DGP-WG/23 is invited to consider whether sodium ion batteries should be incorporated in existing packing instructions for lithium ion batteries, lithium ion batteries packed with equipment and lithium batteries contained in equipment, as shown in Packing Instructions 965 through 967 below, or if they should be incorporated in a stand-alone packing instruction as shown in a proposed new Packing Instruction 97X below.

DGP-WG/UN Harmonization recommends amending the name of the lithium battery hazard label as " Miscellaneious — Lithium or sodium ion batteries" regardless of which alternative DGP-WG/23 prefers. References to the label in Packaging Instructions 965-970 have been amended below accordingly.

Packing Instruction 965

Cargo aircraft only for UN 3480 and UN 3551

1. **Introduction**

This entry applies to lithium ion ~~or~~, lithium polymer or sodium ion batteries. This packing instruction is structured as follows:

— Section IA applies to [lithium ion and sodium ion] cells with a Watt-hour rating in excess of 20 Wh and [lithium ion and sodium ion] batteries with a Watt-hour rating in excess of 100 Wh, which must be assigned to Class 9 and are subject to all of the applicable requirements of these Instructions; and
— Section IB applies to [lithium ion and sodium ion] cells with a Watt-hour rating not exceeding 20 Wh and [lithium ion and sodium ion] batteries with a Watt-hour rating not exceeding 100 Wh.

A single cell battery as defined in Part III, sub-section 38.3.2.3 of the UN *Manual of Tests and Criteria* is considered a "cell" and must be transported according to the requirements for "cells" for the purpose of this packing instruction.

Packing Instruction 965

2. **[Lithium ion and sodium ion] batteries forbidden from transport**

The following applies to all [lithium ion and sodium ion] cells and batteries in this packing instruction:

Cells or batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport.

Waste [lithium ion and sodium ion] batteries and [lithium ion and sodium ion] 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.

IA. **SECTION IA**

Each lithium ion cell or battery must meet the provisions of 2;9.3. Sodium ion cells and batteries must meet the provisions 2;9.4.

IA.1 **General requirements**

— Part 4;1 requirements must be met.
— [Lithium ion and sodium ion] cells and batteries must be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity. Cells and/or batteries at a state of charge greater than 30 per cent of their rated capacity may only be shipped with the approval of the State of Origin and the State of the Operator under the written conditions established by those authorities.

Note.— Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria.

Table 965-IA

UN number and proper shipping name	*Net quantity per package*	
	Passenger	*Cargo*
UN 3480 **Lithium ion batteries** UN 3551 **Sodium ion batteries**	Forbidden	35 kg

IA.2 **Additional requirements**

— [Lithium ion and sodium ion] cells and batteries must be protected against short circuits.
— [Lithium ion and sodium ion] cells and batteries must be placed in inner packagings that completely enclose the cell or battery then placed in an outer packaging. The completed package for the cells or batteries must meet the Packing Group II performance requirements.
— [Lithium ion and sodium ion] cells and batteries must not be packed in the same outer packaging with substances and articles of Class 1 (explosives) other than Division 1.4S, Division 2.1 (flammable gases), Class 3 (flammable liquids), Division 4.1 (flammable solids) or Division 5.1 (oxidizers).
— [A lithium ion or sodium ion] cell or battery with a mass of 12 kg or greater and having a strong, impact-resistant outer casing may be transported when packed in strong outer packagings or protective enclosures (e.g. in fully enclosed or wooden slatted crates) not subject to the requirements of Part 6 of these Instructions, if approved by the appropriate authority of the State of Origin. A copy of the document of approval must accompany the consignment.
— Lithium ~~B~~batteries manufactured after 31 December 2011 and sodium ion batteries manufactured after 31 December 2025 must be marked with the Watt-hour rating on the outside case.

IA.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)		

Packing Instruction 965

IB. **SECTION IB**

[Lithium ion and sodium ion] cells or batteries prepared in accordance with this section are subject to all of the applicable provisions of these Instructions (including the requirements in paragraph 2 of this packing instruction and of this section) except for the provisions of Part 6.

[Lithium ion and sodium ion] cells or batteries shipped in accordance with the provisions of Section IB must be described on a dangerous goods transport document as set in Part 5;4. The packing instruction number "965" required by 5;4.1.5.8.1 a) must be supplemented with "IB". All other applicable provisions of Part 5;4 apply.

Lithium ion cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.3 a), e) and g) or for sodium ion cells or batteries, the provisions of 2;9.4 a), e) and f) and the following:

1) for [lithium ion and sodium ion] cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;

2) for [lithium ion and sodium 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~~ lithium ion batteries manufactured before 1 January 2009;

IB.1 **General requirements**

— 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).
— [Lithium ion and sodium ion] cells and batteries must be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity. Cells and/or batteries at a state of charge greater than 30 per cent of their rated capacity may only be shipped with the approval of the State of Origin and the State of the Operator under the written conditions established by those authorities.

Note.— Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria.

Table 965-IB

Contents	*Net quantity per package*	
	Passenger	*Cargo*
Lithium ion cells and batteries Sodium ion cells and batteries	Forbidden	10 kg

IB.2 **Additional requirements**

— Cells and batteries must be packed in inner packagings that completely enclose the cell or battery then placed in a strong rigid outer packaging.
— Cells and batteries must not be packed in the same outer packaging with substances and articles of Class 1 (explosives) other than Divìsion 1.4S, Division 2.1 (flammable gases), Class 3 (flammable liquids), Division 4.1 (flammable solids) or Division 5.1 (oxidizers).
— Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with electrically conductive material 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 capable of withstanding, without damage to the cells or batteries 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.
— Each package must be marked with the appropriate lithium or sodium ion battery mark (Figure 5-3) in addition to the appropriate Class 9 hazard label (Figure 5-26) and the cargo aircraft only label (Figure 5-28).

Packing Instruction 965

IB.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		

Packing Instruction 966

Passenger and cargo aircraft for UN 3481 and UN 3552 (packed with equipment) only

1. **Introduction**

This entry applies to lithium ion ~~or~~, lithium polymer or sodium ion batteries packed with equipment.

Section I of this packing instruction applies to [lithium ion ~~and~~, lithium polymer and sodium ion] cells and batteries that are assigned to Class 9. Certain [lithium ion ~~and~~, lithium polymer and sodium ion] cells and batteries offered for transport and meeting the requirements of Section II of this packing instruction, subject to paragraph 2 below, are not subject to other additional requirements of these Instructions.

A single cell battery as defined in Part III, sub-section 38.3.2.3 of the UN *Manual of Tests and Criteria* is considered a "cell" and must be transported according to the requirements for "cells" for the purpose of this packing instruction.

For the purpose of this packing instruction, "equipment" means apparatus for which the lithium cells or batteries will provide electrical power for its operation.

2. **[Lithium ion and sodium ion] batteries forbidden from transport**

The following applies to all [lithium ion and sodium ion] cells and batteries in this packing instruction:

Cells or batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport.

I. **SECTION I**

Each lithium ion cell or battery must meet the provisions of 2;9.3. Sodium ion cells and batteries must meet the provisions 2;9.4.

I.1 **General requirements**

Part 4;1 requirements must be met.

UN number and proper shipping name		*Package quantity (Section I)*	
		Passenger	*Cargo*
UN 3481	**Lithium ion batteries packed with equipment**	5 kg of ~~lithium ion~~ cells or batteries	35 kg of ~~lithium ion~~ cells or batteries
UN 3552	**Sodium ion batteries packed with equipment**		

Packing Instruction 966

I.2 **Additional requirements**

- [Lithium ion and sodium ion] 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.
- [Lithium ion and sodium ion] 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.
- Lithium ion ~~B~~batteries manufactured after 31 December 2011 and sodium ion batteries manufactured after 31 December 2025 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)		

II. **SECTION II**

[Lithium ion and sodium ion] cells and batteries packed with equipment, when complying with Section II of this packing instruction, are only subject to the following additional provisions of these Instructions:

- Part 1;2.3 (General — Transport of dangerous goods by post);
- Part 5;2.4.16 (Shipper's responsibilities — Special marking requirements for lithium batteries);
- Part 7;4.4 (Operator's responsibilities — Reporting of dangerous goods accidents and incidents);
- Part 7;4.5 (Operator's responsibilities — Reporting of undeclared and misdeclared dangerous goods);
- Part 8;1.1 (Provisions concerning passengers and crew — Dangerous goods carried by passengers or crew); and
- Paragraphs 1 and 2 of this packing instruction.

Lithium ion cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.3 a), e) and g), or for sodium ion cells or batteries, the provisions of 2;9.4 a), e) and f), and the following:

1) for [lithium ion and sodium ion] cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;

2) for [lithium ion and sodium ion] batteries, the Watt-hour rating is not more than 100 Wh;
   - the Watt-hour rating must be marked on the outside case except for ~~those~~ lithium ion batteries manufactured before 1 January 2009.

II.1 **General requirements**

Contents	*Package quantity (Section II)*	
	Passenger	*Cargo*
Net quantity of [lithium ion and sodium ion] cells or batteries per package	5 kg	5 kg

Packing Instruction 966

II.2 **Additional requirements**

- [Lithium ion and sodium ion] cells and batteries must:
  - be placed in inner packagings that completely enclose the cell or battery, then placed in a strong rigid outer packaging that conforms to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1); or
  - be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a strong rigid outer packaging that conforms to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).
- Cells and batteries must be protected against short circuits. This includes protection against contact with electrically conductive material within the same packaging that could lead to a short circuit.
- 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.
- Each package of cells or batteries, or the completed 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 marked with the appropriate lithium or sodium ion battery mark (Figure 5-3).
  - the package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
- The words "lithium ion batteries" or "sodium ion batteries", "in compliance with Section II of PI966" must be placed on the air waybill, when an air waybill is used. Where packages of Section II[~~lithium~~] batteries from multiple packing instructions are included on one air waybill, the compliance statement for the different[~~lithium~~] battery types and/or packing instructions may be combined into a single statement provided that the statement identifies the applicable[~~lithium~~] battery type(s) and packing instruction numbers.
- Where a package contains a combination of[~~lithium~~] batteries contained in equipment and[~~lithium~~] batteries packed with equipment that meet the limits for[~~lithium~~] cells or batteries of Section II, the following additional requirements apply:
  - the shipper must ensure that all applicable parts of both packing instructions are met. The total mass of lithium batteries contained in any package must not exceed 5 kg;
  - the words "lithium ion batteries" or "sodium ion batteries", "in compliance with Section II of PI966" 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 the functions for which they are responsible.

II.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		

II.4 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the lithium or sodium ion battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word "Overpack" in lettering of at least 12 mm high.

Packing Instruction 967

Passenger and cargo aircraft for UN 3481 and UN 3552 (contained in equipment) only

1. **Introduction**

This entry applies to lithium ion ~~or~~, lithium polymer or sodium ion batteries contained in equipment.

Section I of this packing instruction applies to [lithium ion ~~and~~, lithium polymer and sodium ion] cells and batteries that are assigned to Class 9. Certain [lithium ion ~~and~~, lithium polymer and sodium ion] cells and batteries offered for transport and meeting the requirements of Section II of this packing instruction, subject to paragraph 2 below, are not subject to other additional requirements of these Instructions.

A single cell battery as defined in Part III, sub-section 38.3.2.3 of the UN *Manual of Tests and Criteria* is considered a "cell" and must be transported according to the requirements for "cells" for the purpose of this packing instruction.

For the purpose of this packing instruction, "equipment" means apparatus for which the lithium cells or batteries will provide electrical power for its operation.

2. **[Lithium ion and sodium ion] batteries forbidden from transport**

The following applies to all [lithium ion and sodium ion] cells and batteries in this packing instruction:

Cells or batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport.

I. **SECTION I**

Each lithium ion cell or battery must meet the provisions of 2;9.3. Sodium ion cells and batteries must meet the provisions 2;9.4.

I.1 **General requirements**

Equipment must be packed in strong rigid outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1). Large equipment can be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

UN number and proper shipping name		*Package quantity (Section I)*	
		Passenger	*Cargo*
UN 3481	**Lithium ion batteries contained in equipment**	5 kg of ~~lithium ion~~ cells or batteries	35 kg of ~~lithium ion~~ cells or batteries
UN 3552	**Sodium ion batteries contained in equipment**		

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.
— Lithium ~~B~~batteries manufactured after 31 December 2011 and sodium ion batteries manufactured after 31 December 2025 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		

Packing Instruction 967

II. **SECTION II**

[Lithium ion and sodium ion] cells and batteries contained in equipment, when complying with Section II of this packing instruction, are only subject to the following additional provisions of these Instructions:

— Part 1;2.3 (General — Transport of dangerous goods by post);
— Part 5;2.4.16 (Shipper's responsibilities — Special marking requirements for lithium batteries);
— Part 7;4.4 (Operator's responsibilities — Reporting of dangerous goods accidents and incidents);
— Part 7;4.5 (Operator's responsibilities — Reporting of undeclared and misdeclared dangerous goods);
— Part 8;1.1 (Provisions concerning passengers and crew — Dangerous goods carried by passengers or crew); and
— Paragraphs 1 and 2 of this packing instruction.

Lithium ion cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.3 a), e) and g), or for sodium ion cells or batteries, the provisions of 2;9.4 a), e) and f), and the following:

1) for [lithium ion and sodium ion] cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;

2) for [lithium ion and sodium 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~~ lithium ion batteries manufactured before 1 January 2009.

Devices such as radio frequency identification (RFID) tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be transported when intentionally active. When active, these devices must meet defined standards for electromagnetic radiation to ensure that the operation of the device does not interfere with aircraft systems. The devices must not be capable of emitting disturbing signals (such as buzzing alarms, strobe lights, etc.) during transport.

II.1 **General requirements**

Equipment must be packed in strong rigid outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1). Large equipment can be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

Contents	*Package quantity (Section II)*	
	Passenger	*Cargo*
Net quantity of ~~lithium ion~~ cells or batteries per package	5 kg	5 kg

II.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.
— Cells and batteries must be protected so as to prevent short circuits.
— 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 marked with the appropriate lithium or sodium ion battery mark (Figure 5-3). The package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
   — This requirement does not apply to:
      — packages containing only button cell batteries installed in equipment (including circuit boards); and
      — packages containing no more than four cells or two batteries installed in equipment, where there are not more than two packages in the consignment.
— Where a consignment includes packages bearing the lithium or sodium ion battery mark, the words "lithium ion batteries" or "sodium ion batteries", "in compliance with Section II of PI967" must be placed on the air waybill, when an air waybill is used. Where packages of Section II[~~lithium~~] batteries from multiple packing instructions are included on one air waybill, the compliance statement for the different[~~lithium~~] battery types and/or packing instructions may be combined into a single statement provided that the statement identifies the applicable[~~lithium~~] battery type(s) and packing instruction numbers.
— Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with the functions for which they are responsible.

Packing Instruction 967

II.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		

II.4 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the lithium or sodium ion battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word “Overpack” in lettering of at least 12 mm high.

Packing Instruction 968

Cargo aircraft only for UN 3090

IB. **SECTION IB**

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IB.2 **Additional requirements**

— Cells and batteries must be packed in inner packagings that completely enclose the cell or battery then placed in a strong rigid outer packaging.
— Cells and batteries must not be packed in the same outer packaging with substances and articles of Class 1 (explosives) other than Division 1.4S, Division 2.1 (flammable gases), Class 3 (flammable liquids), Division 4.1 (flammable solids) or Division 5.1 (oxidizers).
— Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with electrically conductive material 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 capable of withstanding, without damage to the cells or batteries 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.
— Each package must be marked with the appropriate lithium or sodium ion battery mark (Figure 5-3) in addition to the appropriate Class 9 hazard label (Figure 5-26) and the cargo aircraft only label (Figure 5-28).

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Packing Instruction 969

Passenger and cargo aircraft for UN 3091 (packed with equipment) only

II. **SECTION II**

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II.2 **Additional requirements**

— Lithium metal cells and batteries must:
  — be placed in inner packagings that completely enclose the cell or battery, then placed in a strong rigid outer packaging that conforms to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1); or
  — be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a strong rigid outer packaging that conforms to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).
— Cells and batteries must be protected against short circuits. This includes protection against contact with electrically conductive material within the same packaging that could lead to a short circuit.
— 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.
— Each package of cells or batteries, or the completed 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 marked with the appropriate lithium or sodium ion battery mark (Figure 5-3).
  — the package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
— The words "lithium metal batteries, in compliance with Section II of PI969" must be placed on the air waybill, when an air waybill is used. Where packages of Section II lithium batteries from multiple packing instructions are included on one air waybill, the compliance statement for the different lithium battery types and/or packing instructions may be combined into a single statement provided that the statement identifies the applicable lithium battery type(s) and packing instruction numbers.
— Where a package contains a combination of lithium batteries contained in equipment and lithium batteries packed with equipment that meet the limits for lithium cells or batteries of Section II, the following additional requirements apply:
  — the shipper must ensure that all applicable parts of both packing instructions are met. The total mass of lithium batteries contained in any package must not exceed 5 kg;
  — the words "lithium metal batteries, in compliance with Section II of PI969" 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 the functions for which they are responsible.

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II.4 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the lithium or sodium ion battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word "Overpack" in lettering of at least 12 mm high.

Packing Instruction 970

Passenger and cargo aircraft for UN 3091 (contained in equipment) only

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II. **SECTION II**

II.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.
- Cells and batteries must be protected so as to prevent short circuits.
- 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 marked with the appropriate lithium or sodium ion battery mark (Figure 5-3). The package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
  - This requirement does not apply to:
    - packages containing only button cell batteries installed in equipment (including circuit boards); and
    - packages containing no more than four cells or two batteries installed in equipment, where there are not more than two packages in the consignment.
- Where a consignment includes packages bearing the lithium or sodium ion battery mark, the words “lithium metal batteries, in compliance with Section II of PI970” must be placed on the air waybill, when an air waybill is used. Where packages of Section II lithium batteries from multiple packing instructions are included on one air waybill, the compliance statement for the different lithium battery types and/or packing instructions may be combined into a single statement provided that the statement identifies the applicable lithium battery type(s) and packing instruction numbers.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with the functions for which they are responsible.

. . .

II.4 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the lithium or sodium ion battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word “Overpack” in lettering of at least 12 mm high.

Alternative stand-alone packing instruction for UN 3551 — Sodium ion batteries and UN 3552 — Sodicum ion batteries packed with equipment and UN 3552 — Sodicum ion batteries contained with equipment:

Packing Instruction 97X

Cargo aircraft only for UN 3551
Passenger and cargo aircraft only for UN 3552

1. Introduction

This entry applies to sodium ion batteries. This packing instruction is structured as follows:

— Section I applies to sodium ion cells with a Watt-hour rating in excess of 20 Wh and sodium ion batteries with a Watt-hour rating in excess of 100 Wh, which must be assigned to Class 9 and are subject to all of the applicable requirements of these Instructions; and
— Section II applies to sodium ion cells with a Watt-hour rating not exceeding 20 Wh and sodium ion batteries with a Watt-hour rating not exceeding 100 Wh.

A single cell battery as defined in Part III, sub-section 38.3.2.3 of the UN *Manual of Tests and Criteria* is considered a "cell" and must be transported according to the requirements for "cells" for the purpose of this packing instruction.

2. Sodium ion batteries forbidden from transport

The following applies to all sodium ion cells and batteries in this packing instruction:

Cells or batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport.

Waste sodium ion batteries and sodium ion 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.

I. SECTION I

Each sodium ion cell or battery must meet the provisions of 2;9.4.

I.1 General requirements

— Part 4;1 requirements must be met.
— [Sodium ion cells and batteries must be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity. Cells and/or batteries at a state of charge greater than 30 per cent of their rated capacity may only be shipped with the approval of the State of Origin and the State of the Operator under the written conditions established by those authorities.]

Note.— Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria.

— Sodium ion batteries manufactured after 31 December 2025 must be marked with the Watt-hour rating on the outside case.

Packing Instruction 97X

I.2 **Requirements — cells and batteries**

— [Sodium ion]cells and batteries must be protected against short circuits.
— [Sodium ion] cells and batteries must be placed in inner packagings that completely enclose the cell or battery then placed in an outer packaging. The completed package for the cells or batteries must meet the Packing Group II performance requirements.
— [[Sodium ion] cells and batteries must not be packed in the same outer packaging with substances and articles of Class 1 (explosives) other than Division 1.4S, Division 2.1 (flammable gases), Class 3 (flammable liquids), Division 4.1 (flammable solids) or Division 5.1 (oxidizers).]
— A sodium ion cell or battery with a mass of 12 kg or greater and having a strong, impact-resistant outer casing may be transported when packed in strong outer packagings or protective enclosures (e.g. in fully enclosed or wooden slatted crates) not subject to the requirements of Part 6 of these Instructions, if approved by the appropriate authority of the State of Origin. A copy of the document of approval must accompany the consignment.

Table 97X-I-1

UN number and proper shipping name	*Net quantity per package*	
	Passenger	*Cargo*
UN 3551 **Sodium ion batteries**	Forbidden	[x kg]

I.3 **Requirements — cells and batteries packed with equipment**

— [Sodium ion] cells or 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 equipment in a packaging that meets the Packing Group II performance requirements.
— The equipment must be secured against movement within the outer packaging.

Table 97X-I-2

UN number and proper shipping name	*Net quantity per package*	
	Passenger	*Cargo*
UN 3552 **Sodium ion batteries packed with equipment**	[x kg]	[x kg]

I.4 **Outer packagings — cells and batteries and cells and batteries packed with equipment**

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)		

I.5 **Requirements — cells and batteries contained in equipment**

— Equipment must be packed in strong, rigid outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1). Large equipment can be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.
— 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.

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Table 97X-I-3

UN number and proper shipping name	*Net quantity per package*	
	Passenger	*Cargo*
UN 3552 **Sodium ion batteries contained in equipment**	[x kg]	[x kg]

I.6 **Outer packagings — cells and batteries contained in equipment**

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

II. SECTION II

Sodium ion cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.4 a), e) and f) and the following:

1) for cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;

2) for 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.

Sodium ion cells and batteries, when complying with Section II of this packing instruction, are only subject to the following additional provisions of these Instructions:

— Part 1;2.3 (General — Transport of dangerous goods by post);
— Part 5;2.4.16 (Shipper's responsibilities — Special marking requirements for lithium batteries);
— Part 7;4.4 (Operator's responsibilities — Reporting of dangerous goods accidents and incidents);
— Part 7;4.5 (Operator's responsibilities — Reporting of undeclared and misdeclared dangerous goods); and
— Paragraphs 1 and 2 of this packing instruction.

— Each package must be marked with the appropriate lithium or sodium ion battery mark (Figure 5-3).
  — The package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
— The words "sodium ion batteries", "in compliance with Section II of PI97X" 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.

II.1 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured in the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the lithium or sodium ion battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be affixed on the outside of the overpack and the overpack must be marked with the word "Overpack" in lettering of at least 12 mm high.

Packing Instruction 97X

II.2 **Requirements — cells and batteries**

— Cells and batteries must be packed in inner packagings that completely enclose the cell or battery then placed in a strong rigid 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.
— Cells and batteries must be packed in strong rigid outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).
[— Cells and batteries must be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity. Cells and/or batteries at a state of charge greater than 30 per cent of their rated capacity may only be shipped with the approval of the State of Origin and the State of the Operator under the written conditions established by those authorities.

Note.— Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria.]

— 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 capable of withstanding, without damage to the cells or batteries 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.

Table 97X-II-1

Contents	*Net quantity per package*	
	Passenger	*Cargo*
Sodium ion cells and batteries	Forbidden	[x kg]

II.3 **Requirements — cells and batteries packed with equipment**

— Sodium ion cells and batteries must:
  — be placed in inner packagings that completely enclose the cell or battery, then placed in a strong rigid outer packaging that conforms to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1); or
  — be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a strong rigid outer packaging 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).
— 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.
— The equipment must be secured against movement within the outer packaging and must be equipped with an effective means of preventing accidental activation.
[— The number of cells or batteries in each package must not exceed the appropriate number 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.]
— Each package of cells or batteries, or the completed 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.
— Where a package contains a combination of batteries contained in equipment and batteries packed with equipment that meet the limits for cells or batteries of Section II, the following additional requirements apply:
  — the shipper must ensure that all applicable parts of both packing instructions are met. The total mass of lithium batteries contained in any package must not exceed [xx kg].

Table 97X-II-2

Contents	*Package quantity (Section II)*	
	Passenger	*Cargo*
Net quantity of sodium ion cells or batteries per package	[x kg]	[x kg]

Packing Instruction 97X

II.4 **Requirements — cells and batteries contained in equipment**

— Devices such as radio frequency identification (RFID) tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be transported when intentionally active. When active, these devices must meet defined standards for electromagnetic radiation to ensure that the operation of the device does not interfere with aircraft systems. The devices must not be capable of emitting disturbing signals (such as buzzing alarms, strobe lights, etc.) during transport.
— Equipment must be packed in strong rigid outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1). Large equipment can be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.
— The equipment must be secured against movement within the outer packaging and must be equipped with an effective means of preventing accidental activation.
— Cells and batteries must be protected so as to prevent short circuits.
— 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.

Table 97X-II-3

Contents	*Package quantity (Section II)*	
	Passenger	*Cargo*
Net quantity of sodium ion cells or batteries per package	[x kg]	[x kg]

II.5 **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		

— END —