



WORKING PAPER

DANGEROUS GOODS PANEL (DGP)

TWENTY-SECOND MEETING

Montréal, 5 to 16 October 2009

Agenda Item 2: Development of recommendations for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2011-2012 Edition

PACKING INSTRUCTIONS FOR LITHIUM CELLS AND BATTERIES

(Presented by J. Rui)

SUMMARY

This paper proposes amendments to Packing Instructions 965, 966, 967, 968, 969 and 970 of the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc. 9284).

Action by the DGP: The DGP is invited to adopt the proposed amendments to Packing Instructions 965, 966, 967, 968, 969 and 970 as presented in the appendix.

1. INTRODUCTION

1.1 The 2009-2010 Edition of the Technical Instructions incorporated a number of revisions to the requirements for the transport of lithium batteries in their respective packing instructions. During At the DGP Working Group of the Whole Meeting in Auckland (DGP-WG09, 4 to 8 May 2009), it was suggested that the new structure of the lithium cells and battery packing instructions made the content unclear and difficult to comply with and a proposal for restructuring was made (DGP/22-WP/3, paragraph 3.5.1.7 refers). General support to enhance clarity was given at the working group but it was suggested this might consist of editing the packing instructions rather than a complete restructuring. One member suggested that a review of how the information was presented in the packing instructions would be useful. It was agreed to amend the reference to an air waybill in the additional requirements of Section II of the packing instructions since the document is usually prepared by a shipper's agent and not the shipper. It was noted that this had caused considerable confusion in industry and it was suggested that by developing the handling label, the need for documentation was redundant.

1.2 The appendix to this working paper proposes a revised presentation of the information in the respective packing instructions relating to lithium cells and batteries taking into account the discussions that took place at DGP-WG09 as well as the comments and feedback received on the use of

these packing instructions. The general requirements that apply to both the fully regulated Class 9 batteries and the "excepted" batteries appear at the top of each packing instruction. These general requirements include the UN test requirements, prohibition on transport of defective batteries and the requirement that batteries be protected against short circuit. The packing instruction indicates that when an air waybill is used for lithium batteries being not restricted, that a statement to that effect and the packing instruction number be shown on the air waybill. This was agreed at DGP/21 but was lost for the lithium batteries previously subject to A45 when the new lithium batteries packing instruction were developed. With respect to the air waybill, in the text relating to the provision of a document, the DGP inserted the words "such as an air waybill" in association with the document. As indicated at DGP-WG09, this is causing much confusion and the proposed alternative wording is aligned with the UN. For Packing Instructions 967 and 970, which apply to lithium batteries contained in equipment, the Technical Instructions require that the requirements of 4.1 be met for the fully regulated batteries. It is proposed that packagings for **equipment** containing batteries just need to meet the lesser requirement specified for the excepted batteries.

APPENDIX
AMENDMENTS TO THE TECHNICAL INSTRUCTIONS

Part 4

PACKING INSTRUCTIONS

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Chapter 11

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PACKING INSTRUCTION 965

Passenger and cargo aircraft for UN 3480

~~This entry applies to lithium ion or lithium polymer batteries in Class 9 (Section I) and lithium ion or lithium polymer batteries subject to specific requirements of these Instructions (Section II).~~

General requirements

The following requirements apply to all lithium ion or lithium polymer cells and batteries transported by air:

- 1) each cell and battery must be of a type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3;
- 2) cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons);
- 3) 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.

Section I below applies to cells and batteries that are assigned to Class 9. Certain lithium ion and lithium polymer cells and batteries offered for transport and meeting the requirements of Section II below, in addition to the general requirements above, are not subject to other additional requirements of these Instructions.

SECTION I

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Part 4;1 requirements must be met.

Each cell or battery must:

- ~~1) be of the type proven to meet the~~ general ~~requirements above~~ requirements above ~~of each test in the UN Manual of Tests and Criteria, Part III, section 38.3; and~~
- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

General requirements

Part 4;1 requirements must be met.

Contents	Package quantity (Section I)	
	Passenger	Cargo
Lithium ion cells and batteries	5 kg G	35 kg G

ADDITIONAL PACKING REQUIREMENTS — SECTION I

- ~~Lithium ion cells and batteries must be protected against short circuits.~~
- Packagings must meet the Packing Group II performance requirements.
- Lithium ion batteries with a mass of 12 kg or greater and having a strong, impact-resistant outer casing, or assemblies of such batteries, may be transported when packed in strong outer packagings and protective enclosures 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.

OUTER PACKAGINGS

Boxes

Aluminium (4B)
Fibreboard (4G)
Natural wood (4C1, 4C2)
Plastic (4H2)
Plywood (4D)
Reconstituted wood (4F)
Steel (4A)

Drums

Aluminium (1B2)
Fibre (1G)
Plastic (1H2)
Plywood (1D)
Steel (1A2)

Jerricans

Aluminium (3B2)
Plastic (3H2)
Steel (3A2)

SECTION II

Lithium ion cells and batteries offered for transport are not subject to other additional requirements of these Instructions if they meet the following requirements ~~of this section~~ in addition to the general requirements above:

~~Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).~~

Lithium ion cells and batteries may be offered for transport if they meet the following:

- 1) for lithium ion cells, the Watt-hour rating (see Glossary of terms in Attachment 2) is not more than 20 Wh;
- 2) for lithium 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 batteries manufactured before 1 January 2009, which may be transported in accordance with the provisions of this section and without the marking until 31 December 2010;
- 3) ~~each cells or~~ batteries ~~is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, section 38.3.~~ must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1) and the additional packing requirements — Section II below.

General requirements

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).

Contents	Package quantity (Section II)	
	Passenger	Cargo
Lithium ion cells and batteries	10 kg G	10 kg G

ADDITIONAL PACKING REQUIREMENTS

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.
- ~~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.~~
- 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 labelled with a lithium battery handling label (Figure 5-31).
- Each consignment must be accompanied with a document ~~such as an air waybill~~ with an indication that:
 - the package contains lithium ion cells or batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - a telephone number for additional information.
- The words “lithium ion batteries”, “not restricted” and “PI 965” must be provided 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.

OUTER PACKAGINGS*Boxes**Drums**Jerricans*

Strong outer packagings

PACKING INSTRUCTION 966

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

~~This entry applies to lithium ion or lithium polymer batteries packed with equipment in Class 9 (Section I) and lithium ion or lithium polymer batteries packed with equipment subject to specific requirements of these Instructions (Section II).~~

General requirements

The following requirements apply to all lithium ion or lithium polymer cells and batteries transported by air:

- 1) each cell and battery must be of a type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3;
- 2) cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons);
- 3) 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.

Section I below applies to cells and batteries that are assigned to Class 9. Certain lithium ion and lithium polymer cells and batteries offered for transport and meeting the requirements of Section II below, in addition to the general requirements above, are not subject to other additional requirements of these Instructions.

SECTION I

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for

assignment to Class 9.

Part 4;1 requirements must be met.

Each cell or battery must:

- 1) ~~be of the type proven to meet the~~ general requirements above ~~requirements of each test in the UN Manual of Tests and Criteria, Part III, section 38.3; and~~
- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

General requirements

Part 4;1 requirements must be met.

Contents	Package quantity (Section I)	
	Passenger	Cargo
Quantity of lithium ion cells and batteries per overpack, excluding equipment	5 kg	35 kg

ADDITIONAL PACKING REQUIREMENTS

- ~~Lithium ion cells and batteries must be protected against short circuits.~~
- ~~The completed package for the cells or batteries must~~ be placed in a packaging that meets the Packing Group II performance requirements.
- The equipment and the packages of lithium cells or batteries must be placed in an overpack. The overpack must bear applicable marks and labels as set out in Part 5;1 and 5;2.4.10.
- For the purpose of this packing instruction, “equipment” means apparatus requiring the lithium ion batteries with which it is packed for its operation.

OUTER PACKAGINGS

<i>Boxes</i>	<i>Drums</i>	<i>Jerricans</i>
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastic (3H2)
Natural wood (4C1, 4C2)	Plastic (1H2)	Steel (3A2)
Plastic (4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

SECTION II

Lithium ion cells and batteries ~~(including lithium polymer) packed with equipment~~ offered for transport are not subject to other additional requirements of these Instructions if they meet the following ~~requirements of this section in~~ addition to the general requirements above:-

~~Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).~~

Lithium ion cells and batteries may be offered for transport if they meet the following:

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

- 2) for lithium 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 batteries manufactured before 1 January 2009, which may be transported in accordance with the provisions of this section and without the marking until 31 December 2010;
- 3) ~~each cell or and battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, section 38.3.~~ must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1) and the "Additional packing requirements – Section II" below.

General requirements

~~Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).~~

ADDITIONAL PACKING REQUIREMENTS — SECTION II

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.
- 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 maximum number of batteries in each package must be the minimum number required to power the equipment, plus two spares.
- Each package of cells or batteries 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 labelled with a lithium battery handling label (Figure 5-31).
- Each consignment must be accompanied with a document ~~such as an air waybill~~ with an indication that:
 - the package contains lithium ion cells or batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - a telephone number for additional information.
- The words "lithium ion batteries", "not restricted" and "PI 966" must be provided 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.

OUTER PACKAGINGS

Boxes

Drums

Jerricans

Strong outer packagings

PACKING INSTRUCTION 967

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

~~This entry applies to lithium ion or lithium polymer batteries contained in equipment in Class 9 (Section I) and lithium ion or lithium polymer batteries contained in equipment subject to specific requirements of these Instructions (Section II).~~

General requirements

The following requirements apply to all lithium ion or lithium polymer cells and batteries transported by air:

- 1) each cell and battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3;
- 2) cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons);
- 3) 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;
- 4) the equipment must be equipped with an effective means of preventing accidental activation;
- 5) equipment containing cells or batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1);
- 6) the equipment containing the cells or lithium batteries must be secured against movement within the outer packaging and be packed so as to prevent accidental operation during air transport.

Section I below applies to cells and batteries that are assigned to Class 9. Certain lithium ion and lithium polymer cells and batteries offered for transport and meeting the requirements of Section II below, in addition to the general requirements above, are not subject to other additional requirements of these Instructions.

SECTION I

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Each cell or battery must:

- ~~1) be of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, section 38.3~~ meet the general requirements above; and
- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

General requirements

~~Part 4;1 requirements must be met.~~

Contents	Net quantity per piece of equipment (Section I)	
	Passenger	Cargo
Lithium ion batteries contained in equipment	5 kg	35 kg

ADDITIONAL PACKING REQUIREMENTS

- Outer packaging must be waterproof or made waterproof through the use of a liner, such as a plastic bag unless the equipment is made waterproof by nature of its construction.
- ~~The equipment must be secured against movement within the outer packaging and be packed so as to prevent accidental operation during air transport.~~

OUTER PACKAGINGS*Boxes**Drums**Jerricans*

Strong outer packagings

SECTION II

Lithium ion cells and batteries (including lithium polymer) contained in equipment offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section in addition to the general requirements above.

~~Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).~~

Lithium ion cells and batteries may be offered for transport if they meet the following:

- 1) for lithium ion cells, the Watt-hour rating (see Glossary of terms in Attachment 2) is not more than 20 Wh;
- 2) for lithium 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 batteries manufactured before 1 January 2009, which may be transported in accordance with the provisions of this section and without the marking until 31 December 2010; and
- 3) ~~each cell or battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, section 38.3.~~ the "Additional packing requirements — Section II" below.

General requirements

~~Equipment must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).~~

ADDITIONAL PACKING REQUIREMENTS — SECTION II

- ~~— The equipment must be equipped with an effective means of preventing accidental activation.~~
- ~~— Cells and batteries must be protected so as to prevent short circuits.~~
- The equipment must be packed in strong outer packagings constructed of suitable material of adequate strength and design in relation to the packaging's capacity and its intended use unless the cell or battery is afforded equivalent protection by the equipment in which it is contained.
- Each package containing more than four cells or more than two batteries installed in equipment must be labelled with a lithium battery handling label (Figure 5-31).
- Each consignment with packages bearing the lithium battery handling label must be accompanied with a document such as an air waybill with an indication that:
 - the package contains lithium ion cells or batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - a telephone number for additional information.
- The words "lithium ion batteries", "not restricted" and "PI 967" must be provided 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.

OUTER PACKAGINGS*Boxes**Drums**Jerricans*

Strong outer packagings

PACKING INSTRUCTION 968

Passenger and cargo aircraft for UN 3090

~~This entry applies. The following requirements apply to all lithium metal or and lithium alloy batteries in Class 9 (Section I) and lithium metal or lithium alloy batteries subject to specific requirements of these Instructions (Section II):~~ cells and batteries transported by air:

- 1) each cell and battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3;
- 2) cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons);
- 3) 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.

Section I below applies to lithium metal and lithium alloy cells and batteries that are assigned to Class 9. Certain lithium metal and lithium alloy cells and batteries offered for transport and meeting the requirements of Section II below, in addition to the general requirements above, are not subject to other additional requirements of these Instructions.

SECTION I

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Part 4;1 requirements must be met.

Each cell or battery must:

- ~~1) be of the type proven to meet the~~ general requirements ~~of each test in the UN Manual of Tests and Criteria, Part III, section 38.3~~ above; and
- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

Cells, and batteries containing one or more cells, with a liquid cathode containing sulphur dioxide, sulphuryl chloride or thionyl chloride which have been discharged to the extent that the open circuit voltage is less than the lower of:

- a) two volts; or
- b) two-thirds of the voltage of the undischarged cell;

are forbidden from transport.

General requirements

Part 4;1 requirements must be met.

Contents	Package quantity (Section I)	
	Passenger	Cargo
Lithium metal cells and batteries	2.5 kg G	35 kg G

ADDITIONAL PACKING REQUIREMENTS

- Lithium metal cells and batteries must be protected against short circuits.
- Packagings must meet the Packing Group II performance requirements.
- Lithium metal batteries with a mass of 12 kg or greater and having a strong, impact-resistant outer casing, or assemblies of such batteries, may be transported when packed in strong outer packagings and protective enclosures 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.
- For lithium metal cells and batteries prepared for transport on passenger aircraft as Class 9:
 - Cells and batteries offered for transport on passenger aircraft must be packed in intermediate or outer rigid metal packaging.
 - Cells and batteries must be surrounded by cushioning material that is non-combustible and non-conductive, and placed inside an outer packaging.

OUTER PACKAGINGS

<i>Boxes</i>	<i>Drums</i>	<i>Jerricans</i>
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastic (3H2)
Natural wood (4C1, 4C2)	Plastic (1H2)	Steel (3A2)
Plastic (4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

SECTION II

Lithium metal ~~or~~ and lithium alloy cells and batteries offered for transport are not subject to other additional requirements of these Instructions if they meet the following requirements ~~of this section~~ in addition to the general requirements, above:

~~Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).~~

Lithium metal or lithium alloy cells and batteries may be offered for transport if they meet the following:

- 1) for a lithium metal or lithium alloy cell, the lithium content is not more than 1 g;
- 2) for a lithium metal or lithium alloy battery, the aggregate lithium metal content is not more than 2 g;
- 3) ~~each cells or~~ and batteries is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, section 38.3. must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1) and the "Additional packing requirements — Section II" below.

General requirements

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).

<i>Contents</i>	<i>Package quantity (Section II)</i>	
	<i>Passenger</i>	<i>Cargo</i>
Lithium metal cells and batteries	2.5 kg G	2.5 kg G

ADDITIONAL PACKING REQUIREMENTS

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.
- ~~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.~~
- Each package of cell or batteries 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 labelled with a lithium battery handling label (Figure 5-31). ~~Each consignment and~~ must be accompanied with a document ~~such as an air waybill~~ with an indication that:
 - the package contains lithium metal cells or batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - a telephone number for additional information.
- The words "lithium metal batteries", "not restricted" and "PI 968" must be provided 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.

OUTER PACKAGINGS

Boxes

Drums

Jerricans

Strong outer packagings

PACKING INSTRUCTION 969

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

~~This entry applies to lithium metal or lithium alloy batteries packed with equipment in Class 9 (Section I) and lithium metal or lithium alloy batteries packed with equipment subject to specific requirements of these Instructions (Section II).~~

General requirements

The following requirements apply to all lithium metal or lithium alloy cells and batteries transported by air:

- 1) each cell and battery is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, subsection 38.3;
- 2) cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons);
- 3) 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.

Section I below applies to lithium metal and lithium alloy cells and batteries that are assigned to Class 9. Certain lithium metal and lithium alloy cells and batteries offered for transport and meeting the requirements of Section II below, in addition to the general requirements above, are not subject to other additional requirements of these Instructions.

SECTION I

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Part 4:1 requirements must be met.

Each cell or battery must:

- 1) ~~be of the type proven to meet the~~ general requirements of each test in the ~~UN Manual of Tests and Criteria, Part III, section 38.3~~ above; and

- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

Cells, and batteries containing one or more cells, with a liquid cathode containing sulphur dioxide, sulphuryl chloride or thionyl chloride which have been discharged to the extent that the open circuit voltage is less than the lower of:

- a) two volts; or
- b) two-thirds of the voltage of the undischarged cell;

are forbidden from transport.

General requirements

~~Part 4;1 requirements must be met.~~

Contents	Package quantity (Section I)	
	Passenger	Cargo
Quantity of lithium metal cells and batteries per overpack, excluding equipment	5 kg	35 kg

ADDITIONAL PACKING REQUIREMENTS

- ~~— Lithium metal cells and batteries must be protected against short circuits.~~
- The ~~completed package for the~~ cells or batteries must be placed in a packaging that meets the Packing Group II performance requirements.
- ~~Each completed package containing lithium cells or batteries must be marked and labelled in accordance with the applicable requirements of 5;1, 5;2 and 5;3.~~
- The equipment and the packages of lithium cells or batteries must be placed in an overpack. The overpack must bear applicable marks and labels as set out in 5;1 and 5;2.4.10.
- For the purpose of this packing instruction, “equipment” means apparatus requiring the lithium batteries with which it is packed for its operation.
- For lithium metal cells and batteries prepared for transport on passenger aircraft as Class 9:
 - Cells and batteries offered for transport on passenger aircraft must be packed in intermediate or outer rigid metal packaging surrounded by cushioning material that is non-combustible and non-conductive and placed inside an outer packaging.

OUTER PACKAGINGS

Boxes

- Aluminium (4B)
- Fibreboard (4G)
- Natural wood (4C1, 4C2)
- Plastic (4H2)
- Plywood (4D)
- Reconstituted wood (4F)
- Steel (4A)

Drums

- Aluminium (1B2)
- Fibre (1G)
- Plastic (1H2)
- Plywood (1D)
- Steel (1A2)

Jerricans

- Aluminium (3B2)
- Plastic (3H2)
- Steel (3A2)

SECTION II

Lithium metal or lithium alloy cells and batteries ~~packed with equipment~~ offered for transport are not subject to other additional requirements of these Instructions if they meet the following requirements ~~of this section~~ in addition to the general requirements, above:-

~~Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).~~

Lithium metal cells and batteries may be offered for transport if they meet the following:

- 1) for a lithium metal or lithium alloy cell, the lithium content is not more than 1 g;
- 2) for a lithium metal or lithium alloy battery, the aggregate lithium metal content is not more than 2 g;
- 3) ~~each cell~~ or and battery ~~ies is of the type proven to meet the requirements of each test in the UN Manual of Tests and Criteria, Part III, section 38.3.~~ are packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1) and the "additional packing requirements — Section II" below.

General requirements

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).

ADDITIONAL PACKING REQUIREMENTS

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.
- ~~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 maximum number of batteries in each package must be the minimum number required to power the equipment, plus two spares.
- Each package of cells or batteries 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 labelled with a lithium battery handling label (Figure 5-31) and -
- ~~Each consignment must be accompanied with a document such as an air waybill with~~ a document with an indication that:
 - the package contains lithium metal cells or batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - a telephone number for additional information.
- The words "lithium metal batteries", "not restricted" and "PI 969" must be provided 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.

OUTER PACKAGINGS

Boxes

Drums

Jerricans

Strong outer packagings

PACKING INSTRUCTION 970

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

~~This entry applies to lithium metal or lithium alloy batteries contained in equipment in Class 9 (Section I) and lithium metal or lithium alloy batteries contained in equipment subject to specific requirements of these Instructions (Section II).~~

General requirements

The following requirements apply to all lithium metal or lithium alloy cells and batteries:

- 1) each cell and battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, subsection 38.3;
- 2) cells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons);
- 3) 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;
- 4) the equipment must be equipped with an effective means of preventing accidental activation;
- 5) equipment containing cells or batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1);
- 6) the equipment containing the cells or lithium batteries must be secured against movement within the outer packaging and be packed so as to prevent accidental operation during air transport.

Section I below applies to lithium metal and lithium alloy cells and batteries that are assigned to Class 9. Certain lithium metal and lithium alloy cells and batteries offered for transport and meeting the requirements of Section II below, in addition to the general requirements above, are not subject to other additional requirements of these Instructions.

SECTION I

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Each cell or battery must:

- 1) ~~be of the type proven to meet the~~ general requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3 above; and
- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

Cells, and batteries containing one or more cells, with a liquid cathode containing sulphur dioxide, sulphuryl chloride or thionyl chloride which have been discharged to the extent that the open circuit voltage is less than the lower of:

- a) two volts; or
- b) two-thirds of the voltage of the undischarged cell;

are forbidden from transport.

General requirements

~~Part 4;1 requirements must be met.~~

Package contents	Net quantity per piece of equipment (Section I)	
	Passenger	Cargo
Lithium metal batteries	5 kg	35 kg

ADDITIONAL PACKING REQUIREMENTS — SECTION I

- Outer packaging must be waterproof or made waterproof through the use of a liner, such as a plastic bag unless the equipment is made waterproof by nature of its construction.
- ~~The equipment must be secured against movement within the outer packaging and be packed so as to prevent accidental operation during air transport.~~
- The quantity of lithium metal contained in any piece of equipment must not exceed 12 g per cell and 500 g per battery.

OUTER PACKAGINGS

Boxes

Drums

Jerricans

Strong outer packaging

SECTION II

Lithium metal and lithium alloy cells and batteries contained in equipment offered for transport are not subject to other additional requirements of these Instructions if they meet the following requirements in addition to the general requirements of this section above:

~~Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).~~

~~Lithium metal cells and batteries may be offered for transport if they meet the following:~~

- 1) for a lithium metal or lithium alloy cell, the lithium metal content is not more than 1 g;
- 2) for a lithium metal or lithium alloy battery, the ~~aggregate lithium~~ metal content is not more than 2 g; and
- 3) ~~each cell or battery is of the type proven to meet the~~ the additional packing requirements of each test in the UN Manual of Tests and Criteria, Part III, section 38.3; — Section II below.

General requirements

~~Equipment containing batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).~~

ADDITIONAL PACKING REQUIREMENTS — SECTION II

- ~~The equipment must be equipped with an effective means of preventing accidental activation.~~
- ~~Cells and batteries must be protected so as to prevent short circuits.~~
- The equipment must be packed in strong outer packagings constructed of suitable material of adequate strength and design in relation to the packaging's capacity and its intended use unless the battery is afforded equivalent protection by the equipment in which it is contained.
- Each package containing more than four cells or more than two batteries installed in equipment must be labelled with a lithium battery handling label (Figure 5-31).
- Each consignment with packages bearing the lithium battery handling label must be accompanied with a document such as an air waybill with an indication that:
 - the package contains lithium metal cells or batteries;
 - the package must be handled with care and that a flammability hazard exists if the package is damaged;
 - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
 - a telephone number for additional information.
- The words "lithium metal batteries", "not restricted" and "PI 970" must be provided 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.

OUTER PACKAGINGS

Boxes

Drums

Jerricans

Strong outer packagings

— END —