



## Guidance Document

### Transport of Lithium Metal and Lithium Ion Batteries Revised for the 2011 Regulations

#### Introduction

This document is based on the provisions set out in the 2011-2012 Edition of the ICAO Technical Instruction for the Safe Transport of Dangerous Goods by Air and the 52<sup>nd</sup> Edition (2010) of the IATA Dangerous Goods Regulations (DGR).

The purpose of this document is to provide guidance for complying with provisions applicable to the transport by air of lithium batteries that took effect 1 January 2009 as set out in the DGR. Specifically the document provides information on:

- Definitions;
- Classification;
- Exceptions;
- Special Provisions;
- Packaging provisions for lithium batteries;
- Prohibitions;
- Passenger Provisions; and
- Frequently Asked Questions

#### Definitions

**Lithium Battery** – The term “lithium battery” refers to a family of batteries with different chemistries, comprising many types of cathodes and electrolytes. For the purposes of the DGR they are separated into:

**Lithium metal batteries.** Are generally primary (non-rechargeable) batteries that have lithium metal or lithium compounds as an anode. Lithium metal batteries are generally used to power watches, calculators, cameras, etc;



Figure 1 - Example of Lithium Metal Batteries

**Lithium-ion batteries** (sometimes abbreviated Li-ion batteries) are a type of secondary (rechargeable) battery commonly used in consumer electronics. Also included within lithium-ion batteries are lithium polymer batteries. Lithium-ion batteries are generally found in mobile telephones, laptop computers, etc.



Figure 2 - Example of a Lithium Ion Battery

### **Transport as Cargo**

#### **Classification**

Lithium batteries are classified in Class 9 – Miscellaneous dangerous goods as:

- UN 3090, **Lithium metal batteries**; and
- UN 3480, **Lithium ion batteries**

or if inside a piece of equipment or packed separately with a piece of equipment as:

- UN 3091, **Lithium metal batteries contained in equipment**; or
- UN 3091, **Lithium metal batteries packed with equipment**; and
- UN 3481, **Lithium ion batteries contained in equipment**; or
- UN 3481, **Lithium ion batteries packed with equipment**.

In the absence of exceptions, these batteries must be shipped in quantities that comply with the limitations contained in the Regulations (see DGR Table 4.2). Also, they must be contained in specification packaging prescribed by the ICAO Technical Instructions and IATA Dangerous Goods Regulations. A completed package must display a Class 9 hazard label in addition to markings that identify the applicable proper shipping name and UN number. A shipper must document the shipment using a Shipper's Declaration for Dangerous Goods.

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## Exceptions

Small lithium metal and lithium ion batteries are excepted from most of the requirements of the ICAO Technical Instructions and IATA DGR provided that they comply with all of the requirements set out in Section II of Packing Instructions 965, 966 and 967 for lithium ion batteries and Section II of Packing Instructions 968, 969 and 970 for lithium metal batteries in the 52<sup>nd</sup> Edition of the IATA DGR.

Packages containing lithium batteries, or lithium batteries contained in, or packed with, equipment that meet the provisions of Section II of these packing instructions are not required to have a Class 9 hazard label and there is no requirement for a Shipper's Declaration for Dangerous Goods for consignments of these batteries. However, in the event of an incident involving these batteries, the incident reporting requirements apply.

### **Note:**

*Only batteries that have successfully passed the test procedures of Part III, Sub-Section 38.3 of the UN Manual of Tests and Criteria qualify under this exception. This is also true for so-called "OEM" or "aftermarket" batteries. Any battery manufacturer or distributor should be able to provide documentation confirming that the batteries have been so tested.*

Lithium metal and lithium ion batteries larger than those described in Section II of the applicable packing instruction must be assigned to Class 9 and consigned as UN 3090 (Lithium metal batteries), UN 3480 (Lithium ion batteries), UN 3091 (Lithium metal batteries contained in equipment or Lithium metal batteries packed with equipment) or UN 3481 (Lithium ion batteries contained in equipment or Lithium ion batteries packed with equipment). All applicable requirements contained in the IATA Dangerous Goods Regulations relating to these commodities must be complied with, including the training requirements; a "Shipper's Declaration for Dangerous Goods" must be issued, and packages must bear the Class 9 hazard label.

## Special Provisions

Lithium batteries are also subject to a number of special provisions which may allow for the transport of batteries other than in accordance with the defined conditions or limits, or which require the shipper to take additional precautions when preparing batteries for transport. The special provisions applicable to lithium batteries are set out following.

Notwithstanding the general requirement that prior to being transported each type of lithium battery must have successfully passed the UN test requirements, there is provision for prototype lithium batteries that have not yet passed the UN test requirements to be shipped for testing purposes, this testing includes pre-production or product compatibility testing, in accordance with Special Provision A88, as follows:

△ **A88** Prototype lithium batteries and cells to be tested that are packed with not more than 24 cells or 12 batteries per packaging that have not been tested to the requirements in sub-section 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 following requirements are met:

- (a) the cells and batteries must be transported in an outer packaging that is a metal, plastic or plywood drum or a metal, plastic or wooden box and that meets the criteria for Packing Group I packagings;
- (b) each cell and battery must be individually packed in an inner packaging inside an outer packaging and surrounded by cushioning material that is non-combustible, and non-conductive. Cells and batteries must be protected against short-circuiting.
- (c) lithium batteries with a mass of 12 kg or greater and having a strong, impact resistant outer casing, or assemblies of such batteries, may be packed in strong outer packagings or protective enclosures not subject to the requirements of Section 6 of these Regulations. The batteries or battery assemblies must be protected against short circuiting; and
- (d) a copy of the document of approval showing the quantity limitations must accompany the consignment.

Irrespective of the limit specified in Column L of Table 4.2, the battery or battery assembly as prepared for transport may have a mass exceeding 35 kg G.

For air transport, specific quantity limits apply to the gross weight of each package that contains lithium batteries. The gross weight includes the weight of all of the packaging materials as well as the weight of batteries. The maximum weight for packages consigned for carriage as Cargo Aircraft Only is 35 kg gross. However, there is provision for large batteries that have a weight that exceed the 35 kg packaged weight to be consigned on a cargo aircraft in accordance with Special Provision A99 as follows:

△ **A99** Irrespective of the per package quantity limit for cargo aircraft specified in Column L of the List of Dangerous Goods (Subsection 4.2), and in Section I of Packing Instructions 965, 966, 967, 968, 969 or 970, a lithium battery or battery assembly (UN 3090 or UN 3480), including when packed with, or contained in equipment (UN 3091 or UN 3481) that meets the other requirements of Section I of the applicable packing instruction may have a mass exceeding 35 kg, if approved by the appropriate authority of the State of origin. A copy of the document of approval must accompany the consignment.

There will be occasion where a manufacturer may wish to have a defective battery returned for analysis. However, where such batteries may pose a safety risk they are prohibited from transport by air as set in Special Provision A154, as follows:

**A154** 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).

One of the major risks associated with the transport of batteries and battery-powered equipment is short-circuit of the battery as a result of the battery terminals coming into contact with other batteries or metal objects. Special Provision A164 require that all batteries and battery-powered equipment must be packed to prevent short circuit and inadvertent operation as follows:

**A164** Any electrical battery or battery-powered device, equipment of vehicle having the potential of a dangerous evolution of heat must be prepared for transport so as to prevent:

- (a) a short circuit (e.g. in the case of batteries by the effective insulation of exposed terminals; or in the case of equipment, by disconnection of the battery and protection of exposed terminals); and
- (b) unintentional activation.

When a shipment of a combination of lithium batteries contained in equipment and lithium batteries packed with equipment is presented for transport, the classification is to be lithium batteries packed with equipment as indicated by special provision A181.

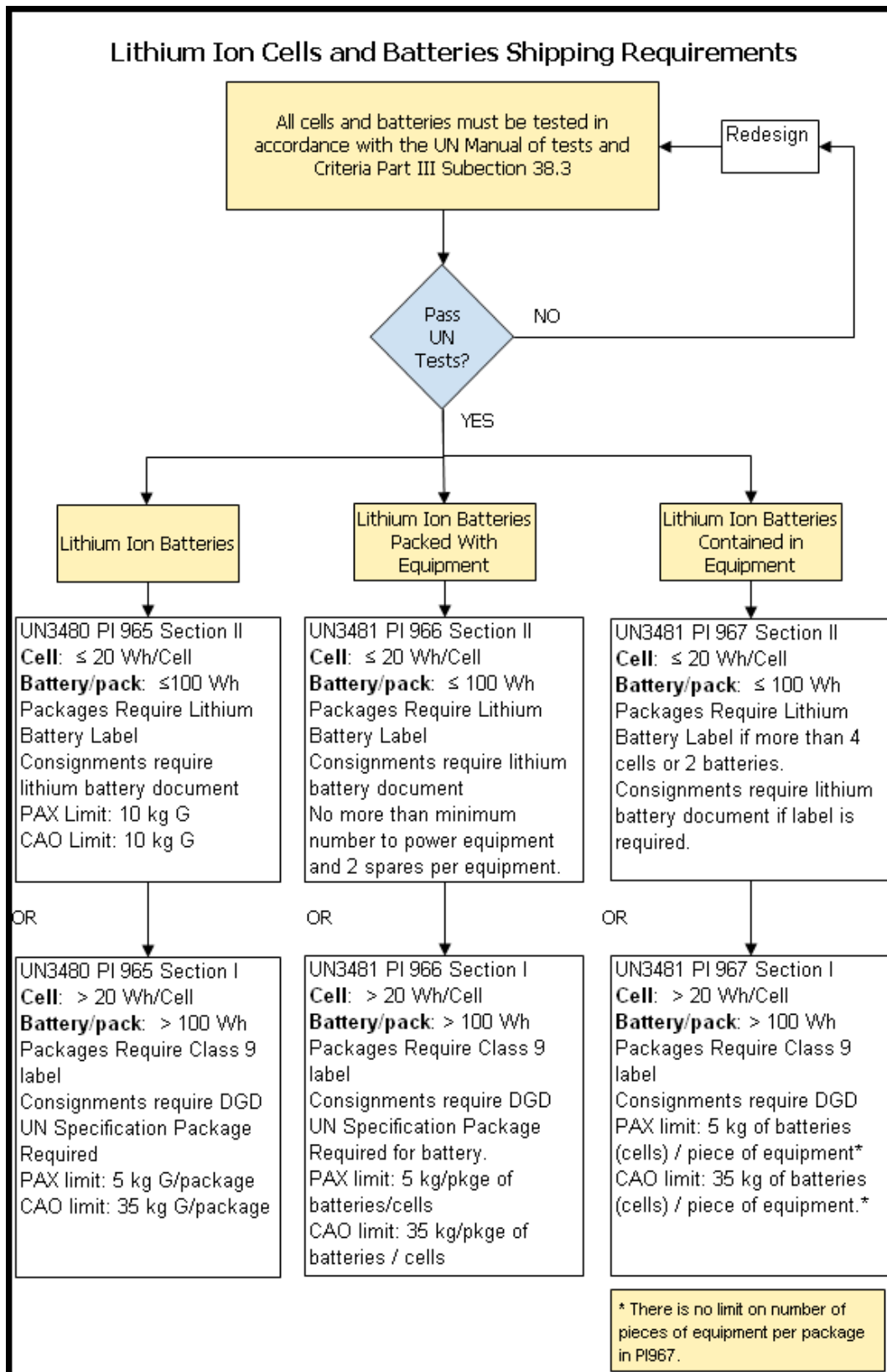
- ☐ **A181** When a package contains a combination of lithium batteries contained in equipment and lithium batteries packed with equipment, the package must be marked UN 3091 Lithium metal batteries packed with equipment, or UN 3481 Lithium ion batteries packed with equipment as appropriate. If a package contains both lithium ion batteries and lithium metal batteries, the package must be marked as required for both battery types. However, button cell batteries installed in equipment (including circuit boards) need not be considered.

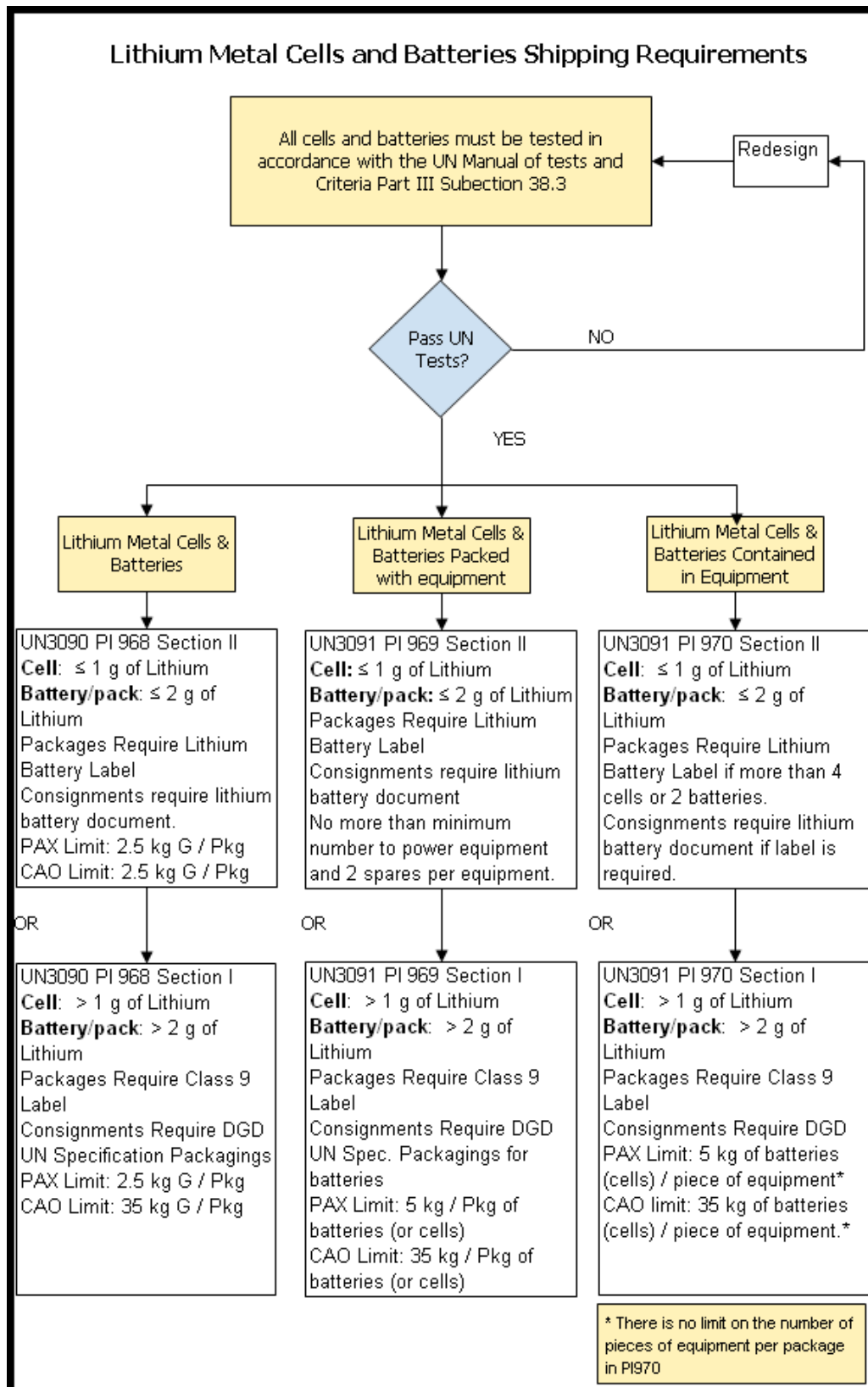
Questions have been asked regarding whether to classify equipment with lithium batteries as battery-powered equipment, or only lithium batteries contained in equipment. Special Provision A182 makes it clear that the requirement is to use the lithium battery specific entries when only those batteries are present.

- ☐ **A182** Equipment containing only lithium batteries must be classified as either UN 3091 or UN 3481.

It has been clarified that waste batteries are not permitted in air transport with the addition of Special Provision A183.

- ☐ **A183** Waste batteries and batteries being shipped for recycling or disposal are prohibited from air transport unless approved by the appropriate national authority of the State of Origin and the State of the Operator.





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## Prohibitions

### **Transport to, from or through the United States**

Lithium metal batteries shipped to, from or through the United States are subject to additional limitations specified in the US national dangerous goods regulations contained in Code of Federal Regulations Title 49 (49 CFR). The basis of these limitations is reflected in State Variation USG-02, which states that:

Primary (non-rechargeable) lithium metal batteries and cells, (UN 3090), are forbidden for transportation aboard passenger-carrying aircraft. Such batteries transported in accordance with Section I of Packing Instruction 968 must be labelled with the CARGO AIRCRAFT ONLY label. Such batteries transported in accordance with Section II of Packing Instruction 968 must be marked "PRIMARY LITHIUM BATTERIES — FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" or "LITHIUM METAL BATTERIES — FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT".

Primary (non-rechargeable) lithium metal batteries and cells contained in or packed with equipment (UN 3091) are forbidden for transportation aboard passenger-carrying aircraft unless:

1. the equipment and the batteries and cells are transported in accordance with Packing Instruction 969 or 970, as appropriate;
2. the package contains no more than the number of lithium metal batteries or cells necessary to power the intended piece of equipment;
3. the lithium content of each cell, when fully charged, is not more than 5 grams;
4. the aggregate lithium content of the anode of each battery, when fully charged, is not more than 25 grams; and
5. the net weight of lithium batteries does not exceed 5 kg (11 lb).

Primary (non-rechargeable) lithium metal batteries and cells contained in or packed with equipment (UN 3091) and transported in accordance with Section I of Packing Instruction 969 or 970 that do not conform to the above provisions are forbidden for transportation aboard passenger-carrying aircraft and must be labelled with the CARGO AIRCRAFT ONLY label.

Primary (non-rechargeable) lithium metal batteries and cells contained in or packed with equipment (UN 3091) and transported in accordance with Section II of Packing Instruction 969 or 970 that do not conform to the above provisions are forbidden for transportation aboard passenger-carrying aircraft and must be marked "PRIMARY LITHIUM BATTERIES — FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" or "LITHIUM METAL BATTERIES — FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT".

## Passenger Provisions

### Transport within Passenger Baggage

Certain restrictions apply to the carriage of lithium metal and lithium ion batteries even when carried by passengers as baggage. Once again, only batteries that have successfully passed the Tests outlined in Part III, Sub-Section 38.3 of the UN Manual of tests and criteria may be carried.

As said before batteries manufactured, distributed or sold by major companies do meet this requirement, however, certain replacement batteries which are not OEM or aftermarket batteries but simply low-cost copies of those – also called “fakes” – may not have undergone the required tests. Untested batteries are consequently excluded from air transport.

Users of equipment powered by lithium metal and lithium ion batteries should therefore be vigilant when buying replacement batteries from unknown sources, such as on markets or Internet auction platforms. The differences between genuine and copied battery types may not be visible but could be very dangerous; such untested batteries may have a risk of overheating or causing fires.

Because of the risks associated with the carriage of spare batteries these may not be transported within passenger checked baggage. Spare batteries must be in carry-on baggage.

These requirements are stipulated by subparagraph 2.3.5.9 of the IATA Dangerous Goods Regulations:

△ **2.3.5.9** Portable electronic devices (watches, calculating machines, cameras, cellular phones, lap-top computers, camcorders, etc.) containing lithium metal or lithium ion cells or batteries when carried by passengers or crew for personal use, which should be carried in carry-on baggage. Spare batteries must be individually protected to prevent short circuits by placement in the original retail packaging or by otherwise insulating terminals, e.g. by taping over exposed terminals or placing each battery in a separate plastic bag or protective pouch, and carried in carry-on baggage only. In addition, each installed or spare battery must not exceed the following quantities:

- (a) for lithium metal or lithium alloy batteries, a lithium content of not more than 2 g; or
- (b) for lithium ion batteries, a watt-hour rating of not more than 100 Wh.

There is also provision, with the approval of the airline, for larger lithium ion batteries with a watt-hour rating in excess of 100 Wh, but not more than 160 Wh in equipment and no more than two spare lithium ion batteries as set out in subparagraph 2.3.3.2 as follows:

**2.3.3.2** Lithium ion batteries exceeding a watt-hour rating of 100 Wh but not exceeding 160 Wh may be carried as spare batteries in carry on baggage, or in equipment in either checked or carry on baggage. No more than two individually protected spare batteries per person may be carried.

Although the text provided above does not impose a limit on the number of lithium metal and lithium ion batteries that fall under the 2 g or 100 Wh limitation (See 2.3.5.9) being

carried as spares within a passenger's carry-on baggage it must be emphasized that the number of spares must be "reasonable" in the context of the equipment used by the passenger and his or her itinerary. Furthermore, these must be intended to power portable electronic devices (including, but not limited to, cameras and professional film equipment, laptop computers, MP3 players, cell phones, Personal Digital Assistants (PDA's), pocket calculators etc.

Batteries which are carried for the purpose of resale or beyond personal needs are clearly not covered.

The regulations imposed on these commodities by the United States competent authorities (Department of Transportation and FAA) match the ICAO / IATA regulations addressed in this document.

## **Frequently Asked Questions**

### **Part 1 – Questions Related to Definitions**

#### **A. What are the various types of lithium batteries?**

Lithium batteries fall into two broad classifications; lithium metal batteries and lithium ion batteries. Lithium metal batteries are generally non-rechargeable and contain metallic lithium. Lithium ion batteries do not contain metallic lithium and are rechargeable.

#### **B. What are lithium polymer batteries?**

A lithium polymer battery is a type of lithium ion battery. Generally, the main difference is lithium ion polymer batteries contain a polymer electrolyte.

#### **C. What is the difference between a lithium cell and a lithium battery?**

A lithium cell is a single encased electrochemical unit consisting of one positive and one negative electrode that exhibits a voltage differential across the two terminals. A lithium battery is one or more cells electrically connected. A single cell battery is considered a cell and not a battery.

*Note: Units that are commonly referred to as "battery packs" having the primary function of providing a source of power to another piece of equipment are for the purposes of these Regulations treated as batteries.*

#### **D. How are component cells connected to form a battery?**

Cells in batteries may be connected in parallel, in series, or in a combination of the two. When cells are connected in series the voltage of the battery increases but the capacity in ampere-hours (Ah) does not change. By contrast, when cells are connected in parallel the capacity in ampere-hours of the battery (Ah) increases but the voltage stays the same.

### **E. How do I determine the watt-hour rating for a particular lithium ion battery?**

The watt-hour (Wh) rating is a measure by which lithium ion batteries are regulated. Lithium ion batteries manufactured after 1 January 2009 are required to be marked with the watt-hour rating.

You can also arrive at the number of watt-hours your battery provides if you know the battery's nominal voltage (V) and capacity in ampere-hours (Ah):

$$\text{Ah} \times \text{V} = \text{Wh}$$

This information is often marked on the battery.

Note that if only the milli-ampere-hours (mAh) are marked on the battery then divide that number by 1000 to get ampere-hours (Ah) (i.e. 4400 mAh / 1000 = 4.4. Ah).

Most lithium ion batteries marketed to consumers are below 100 watt-hours. If you are unsure of the watt-hour rating of your lithium ion battery, contact the manufacturer.

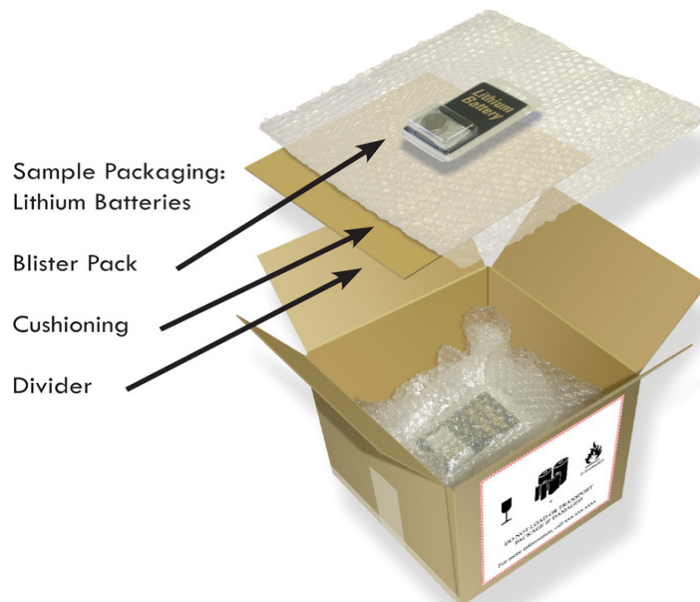
### **F. What is a button cell battery?**

A button cell battery is a round small cell or battery where the overall height is less than the diameter.

## **Part 2 – Questions related to Packaging and Transport Provisions**

### **A. How do I safely package lithium batteries for transport?**

One of the major risks associated with the transport of batteries and battery-powered equipment is short-circuit of the battery as a result of the battery terminals coming into contact with other batteries, metal objects, or conductive surfaces. Packaged batteries or cells must be separated in a way to prevent short circuits and damage to terminals. They must be packed in a strong outer packaging or be contained in equipment. Sample packaging meeting these requirements is shown below:



**B. How can batteries be effectively protected against short circuit?**

Methods to protect against short circuit include, but are not limited to, the following methods:

- a) Packing each battery or each battery-powered device when practicable, in fully enclosed inner packagings made of non-conductive material (such as a plastic bag);
- b) Separating or packing batteries in a manner to prevent contact with other batteries, devices or conductive materials (e.g., metal) in the packagings; and
- c) Ensuring exposed terminals or connectors are protected with non-conductive caps, non-conductive tape, or by other appropriate means.

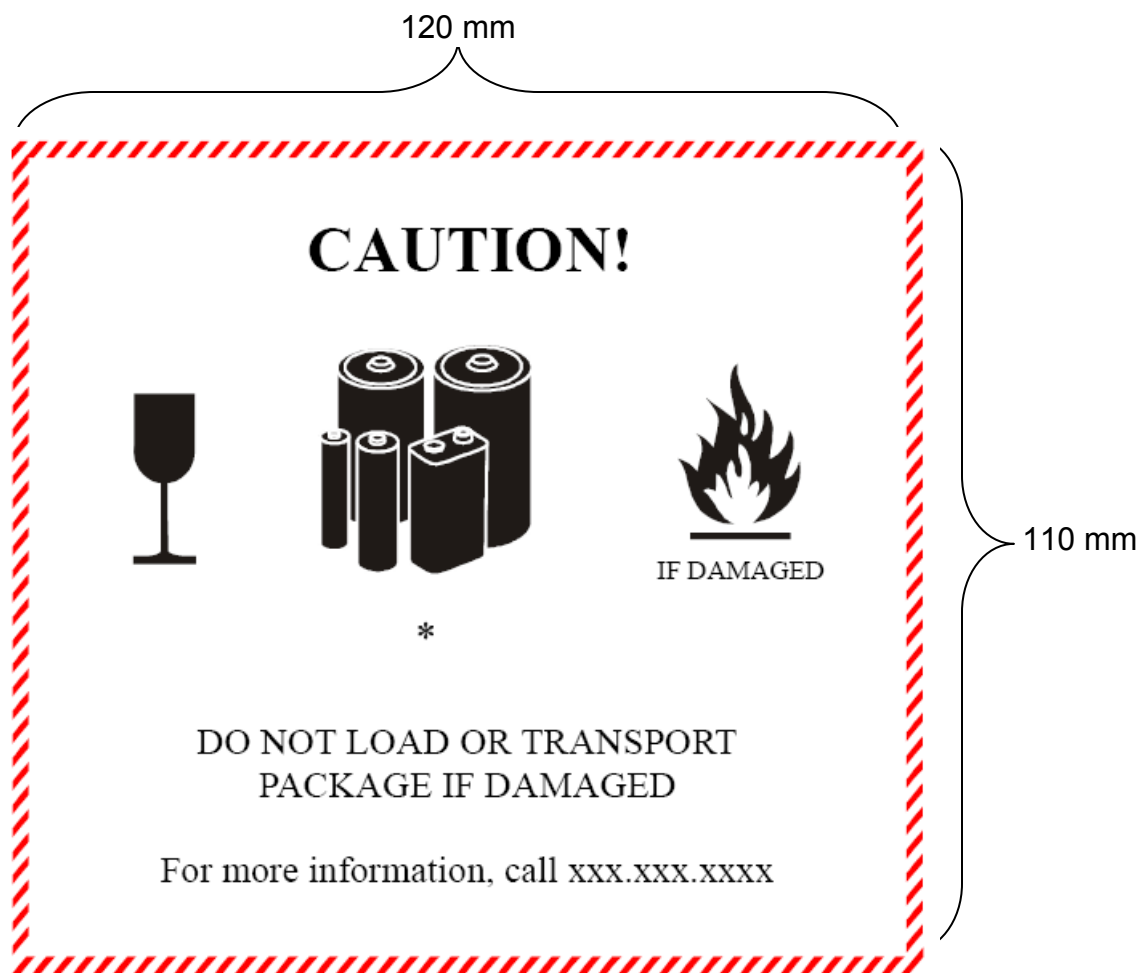
If not impact resistant, the outer packaging should not be used as the sole means of protecting the battery terminals from damage or short-circuiting. Batteries should be securely cushioned and packed to prevent shifting which could loosen terminal caps or reorient the terminals to produce short circuits.

Terminal protection methods include but are not limited to the following:

- a) Securely attaching covers of sufficient strength to protect the terminals;
- b) Packaging the battery in a rigid plastic packaging; and
- c) Constructing the battery with terminals that are recessed or otherwise protected so that the terminals will not be subjected to damage if the package is dropped.

### C. What does the new lithium battery handling label look like and when is it required?

The new lithium battery handling label is required as specified in the additional requirements of Section II of packing instructions 965, 966, 967, 968, 969 and 970. The new label is as shown in Figure 7.4.I IATA Dangerous Goods Regulations. The border of the label must have red diagonal hatchings with text and symbols in black on a contrasting background. The lithium battery handling label may be printed directly on the outer packaging provided that there is sufficient contrast between the elements of the lithium battery handling label and the colour of the packaging material. The minimum dimensions are 120 mm x 110 mm



\* Place for "Lithium ion battery" and/or "Lithium metal battery"

- ☐ **D. If I have smaller packages, can I use a smaller lithium battery handling label?**

Where the packages are of dimensions such that they can only bear smaller labels the label dimensions may be 74 mm × 105 mm. The design specifications remain otherwise the same.



**E. When is a lithium battery handling label not required?**

A lithium battery handling label is not required for packages prepared in accordance with Section I of Packing Instructions 965-970 (i.e. bearing a Class 9 label) or when a package contains no more than 4 cells or 2 batteries installed in equipment prepared in accordance with Section II of Packing Instructions 967 and 970. This applies to UN 3481 Lithium ion batteries contained in equipment (See Section II of Packing Instruction 967) and UN3091 Lithium metal batteries contained in equipment (see Section II of Packing Instruction 970), except that button cells installed in equipment (including circuit boards) need not be considered. As these packages do not require a lithium battery handling label, the accompanying document mentioned in the "Additional Requirements" of Section II of Packing Instructions 967 and 970 is not required.

- ☐ **Note:** The Air Waybill must still contain the required statement "Lithium (ion or metal) batteries, Not Restricted, PI9xx"

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**F. Is there a requirement for the Lithium Battery Handling Label to be available in languages other than English?**

English is generally the standard language accepted in international aviation. However, the State of origin where offering the package for shipment may require their official language. Subsection 7.1.3.3 of the IATA DGR specifies that in addition to the languages which may be required by the State of origin, English must be used.

**G. Section II in Packing Instructions 967 and 970 states that "Each package containing more than four cells or more than two batteries installed in equipment must be labelled with a lithium battery handling label." What is the intent of this provision?**

This provision authorizes packages with equipment containing no more than 2 batteries or 4 cells to be offered for transport without the lithium battery handling label. For example, a package containing a notebook computer may have 1 lithium ion battery and 2 small lithium metal coin cells installed in the product. This single package does not require the lithium battery handling label. The number of cells contained inside the lithium ion battery are NOT counted towards the 4 cell limitation because it is the battery installed in the equipment being presented for transport. In addition, multiple packages each containing no more than 2 batteries or 4 cells may be overpacked and neither the individual packages nor the overpack would require the label.

**H. I have an MP3 player that contains one single-cell lithium ion battery pack. Do I have to label the shipping box that contains each MP3 player? What if I place five MP3 players in a shipping box? Does this require a label?**

For packages of single MP3 players, no lithium battery label would be required since you can place up to 4 of these single-cell batteries in a box without labelling the outer box. In the case where 5 MP3 players are in a shipping package, a lithium battery label on the outer shipping package would be required.

**I. Can a single label be used to identify that both lithium metal and lithium ion batteries are contained inside the package?**

Yes. A single label identifying both lithium ion and lithium metal batteries may be used.

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**J. What are the requirements for the telephone number on the lithium battery handling label?**

The telephone number should be of a person knowledgeable about the shipment but is not intended to be for the purposes of obtaining immediate emergency response guidance, and is therefore not required to be monitored at all times that the package is in transit. It is acceptable for the number to be monitored during the company's normal business hours in order to provide product-specific information relative to the shipment. However, it also is acceptable to use an emergency response, 24-hour phone number on the label.

**K. For the purposes of the lithium battery packing instructions, what is considered the "package"?**

The package is the complete product of the packing operation that satisfies the requirement of the packing instruction. The package may contain multiple batteries or pieces of equipment provided the limitations set out in the applicable packing instruction are not exceeded. The package must be marked and labelled as required by the packing instruction. A single package may be offered for transport, or one or more packages may then be placed into an overpack for ease of handling or transport purposes. When an overpack is used, the package markings and labels must be duplicated on the overpack unless the markings and labels required on individual packages are visible, or are not required by the packing instruction (i.e. less than 4 cells or 2 batteries when contained in equipment).

**L. Please explain the documentation requirements for consignments of lithium batteries that are required to have the lithium battery label?**

Each consignment of packages with lithium batteries that is required to have the lithium battery handling label must be accompanied by a document such as an airway bill or other document that indicates:

- 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.

This document may be in any form provided it contains all the appropriate information and accompanies the consignment. For example, the document may be provided separately to the carrier or in a pouch attached to the package.

**M. Does IATA require an MSDS containing the UN test data?**

No. IATA does not require the use of MSDS and test data is not part of the required documentation requirements when offering lithium batteries for transport.

- N. Under Packing Instructions 966 and 969, it states that “The maximum number of batteries in each package must be the minimum number required to power the equipment, plus two spares”. If a package contains 4 power tools (each tool contains a lithium ion battery), can 2 extra lithium ion batteries be placed in the package for each piece of equipment for a total of 8 batteries?**

Yes. The 8 batteries reflect two spares for each of the 4 power tools in the outer package.

- O. May lithium battery packages be placed in an overpack in accordance with the new IATA Dangerous Goods Regulations?**

Yes. The overpack may also contain packages of dangerous goods or goods not subject to the Regulations provided there are no packages enclosing different substances which might react dangerously with each other. An overpack must be marked with the word “overpack” and must be labelled with the lithium battery handling label (Figure 7.4.I), unless the label(s) on the package(s) inside the overpack are visible or not required by the Packing Instruction.

In addition, the word “overpack” must be marked on overpacks containing packages transported in accordance with Section I of the applicable Packing Instructions (i.e. bearing Class 9 labels).

- P. Do the quantity limits shown in the IATA packing instructions apply to overpacks containing lithium batteries?**

The quantity limits shown in packing instructions 965 and 968, refer to the package. Provided each package remains under the limit specified in the packing instruction, the overpack may exceed the specified limits.

- Q. Packing Instructions 966 and 969 Section II include a requirement for a 1.2 metre drop test. What portion or portions of the package are subject to this test?**

The completed package containing batteries as prepared for transport in accordance with the relevant packing instruction must be capable of withstanding the 1.2 m drop test. This could apply to a package solely containing batteries that is packaged in full compliance with the provisions of the packing instruction (to include the 1.2 m drop test capability requirement) and is then overpacked with equipment and offered for transport (see item 2N for additional information related to overpacks). Or, it could apply to a package that includes batteries properly packed in inner packaging and equipment or other non-dangerous goods that are placed in a single outer packaging. The package that includes both the inner packaging containing batteries and the equipment must comply with the packing instruction to include meeting the capability to pass the 1.2 m drop test.

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**R. How do I transport prototype lithium cells and batteries that have not been UN Tested?**

Prototype lithium batteries may be transported by cargo aircraft if you do the following:

1. Obtain approval from the competent authority of the origin country prior to transport;
2. Place no more than 12 batteries or 24 cells in a package;
3. Protect the cells and batteries from short circuiting;
4. Pack each of the cells or batteries in an inner packaging inside an outer packaging that completely surrounds the cells and batteries. All packaging and cushioning material must be non-conductive and non-combustible
5. Place the cells and batteries in an outer drum or box made of metal, plastic or plywood that meets Packing Group I performance requirements.

**S. Can I ship recalled, damaged or non-conforming cells or batteries?**

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). The U.S. DOT has developed guidance for consumers and manufacturers for shipping recalled batteries:

[http://safetravel.dot.gov/Battery\\_Recall\\_Guidance.pdf](http://safetravel.dot.gov/Battery_Recall_Guidance.pdf)

Batteries which have some other defective feature (e.g., LEDs not showing charge, incorrect model number on label, or batteries not holding enough charge) could still be shipped by air. Also, laptops being returned may not have a defective battery, it may not meet the needs of the customer, may be defective itself (but not the battery), etc. In these situations air transport would be permitted. The battery or equipment manufacturer should be contacted to determine the appropriate shipping method.

**T. How do I protect against “inadvertent activation”?**

When batteries are contained in equipment, the equipment should be packaged in a manner that prevents unintentional activation or should have an independent means of preventing unintentional activation (e.g., packaging restricts access to activation switch, switch caps or locks, recessed switches, trigger locks, temperature sensitive circuit breakers, etc.). This requirement does not apply to devices which are intentionally active in transport (RFID transmitters, watches, sensors etc.) and which are not capable of generating a quantity of heat sufficient to be dangerous to packaging or personal safety.

**U. What is the maximum weight of batteries per package for fully regulated batteries contained in equipment (Section I)?**

The maximum weight is per piece of equipment. There is no maximum on the number pieces of "equipment" placed into one package, provided the package meets all the requirements of Section I.

|                                                 | <b>Passenger &amp; Cargo Aircraft</b> | <b>Cargo Aircraft Only</b>   |
|-------------------------------------------------|---------------------------------------|------------------------------|
| Lithium Ion & Lithium Metal cells and batteries | 5 kg per piece of equipment           | 35 kg per piece of equipment |

☐ **V. Do I need to declare a gross weight or a net weight for lithium batteries (Section I)?**

- UN3480, Lithium ion batteries: A gross weight is required as a gross weight is indicated in Section 4.2
- UN3481, Lithium ion batteries packed with equipment: A net weight is required as 8.1.6.9.2 (d)(1) indicates. The limit per package is found in Packing Instruction 966.
- UN3481, Lithium ion batteries contained in equipment: A gross weight is required as these are articles with a packing instruction reference in 4.2 (See DGR 8.1.6.9.2 (d) (3).
- UN3090, Lithium metal batteries: A gross weight is required as a gross weight is indicated in Section 4.2.
- UN3091, Lithium metal batteries packed with equipment: A net weight is required as 8.1.6.9.2 (d)(1) indicates. The limit per package is found in Packing Instruction 969.
- UN3091, Lithium metal batteries contained in equipment: A gross weight is required as these are articles with a packing instruction reference in 4.2 (See DGR 8.1.6.9.2 (d) (3).

**Part 3 – Questions Related to Design Type Testing Provisions**

**A. Where can I find requirements related to testing of battery design types?**

The UN Manual of Tests and Criteria sets out specific tests that must be conducted on each lithium cell or battery design type. Each test is intended to either simulate a common transportation occurrence such as vibration or changes in altitude or to test the integrity of a cell or battery. You may obtain a copy of these testing requirements via the following website: [http://www.unece.org/trans/danger/publi/manual/manual\\_e.html](http://www.unece.org/trans/danger/publi/manual/manual_e.html).

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**B. What constitutes a design change requiring renewed design type testing?**

A cell or battery that differs from a tested design by more than 0.1 grams or 20 % to the anode, cathode or electrolyte is considered to be a design change. A change that would materially affect the test results is also a design change.

Examples of design changes include the use of a different type of cathode material, a change in the battery's geometry or different component cells.

**Part 4 – Questions Related to State and Operator Variations**

**A. What additional requirements are imposed by US Variation USG-02?**

The United States restricts the transport of certain primary (non-rechargeable) lithium metal batteries, both packaged batteries and those packed with or contained in equipment, from transport on passenger carrying aircraft. In accordance with USG-02, primary (non-rechargeable) lithium metal batteries and cells (UN3090) are forbidden for transportation aboard passenger-carrying aircraft. Such batteries transported in accordance with Section I of Packing Instruction 968 must be labelled with the cargo aircraft only label. Such batteries transported in accordance with Section II of Packing Instruction 968 must be marked "PRIMARY LITHIUM BATTERIES — FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" or "LITHIUM METAL BATTERIES — FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT".

Primary (non-rechargeable) lithium metal batteries and cells contained in or packed with equipment (UN3091) are forbidden for transportation aboard passenger-carrying aircraft unless:

- 1) The equipment and the batteries and cells are transported in accordance with Packing Instruction 969 or 970, as appropriate;
- 2) The package contains no more than the number of lithium metal batteries or cells necessary to power the intended piece of equipment;
- 3) The lithium content of each cell, when fully charged, is not more than 5 grams;
- 4) The aggregate lithium content of the anode of each battery, when fully charged, is not more than 25 grams; and
- 5) The net weight of lithium batteries does not exceed 5 kg (11 pounds).

Primary (non-rechargeable) lithium metal batteries and cells contained in or packed with equipment (UN3091) and transported in accordance with Section I of Packaging Instruction 969 or 970 that do not conform to the above provisions are forbidden for transportation aboard passenger carrying aircraft and must be labelled with the cargo aircraft only label.

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Primary (non-rechargeable) lithium metal batteries and cells contained in or packed with equipment (UN3091) and transported in accordance with Section II of Packaging Instruction 969 or 970 that do not conform to the above provisions are forbidden for transportation aboard passenger carrying aircraft and must be marked “PRIMARY LITHIUM BATTERIES — FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT” or “LITHIUM METAL BATTERIES — FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT”.

☐ **B. Do any airlines impose additional requirements on the transport of lithium batteries as Cargo?**

Yes. The following airlines have filed variations regarding lithium batteries:

British Airways (BA)

Continental Airlines (CO)

Continental Micronesia (CS)

China Southern (CZ)

Federal Express (FX)

SAS – Scandinavian Airlines System (SK)

Spanair (JK)

It is recommended to contact those airlines or consult their variation in the IATA Dangerous Goods Regulations for further details.

Further information can be found here:

[http://www.iata.org/whatwedo/cargo/dangerous\\_goods/index.htm](http://www.iata.org/whatwedo/cargo/dangerous_goods/index.htm)

<http://safetravel.dot.gov>

You may also contact the airline of your choice or your national civil aviation authority if you have any further concerns about travelling with lithium metal or lithium ion batteries.

You can also contact the IATA Dangerous Goods Support team if you have questions or concerns which may not have been addressed in this document: [dangood@iata.org](mailto:dangood@iata.org)

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