

LITHIUM BATTERIES

Note: In the U.S., new regulations governing the shipment of lithium batteries are expected to be proposed some time in 2012. Readers of this information are urged to monitor the work of the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) for up to date information. Consult the following PHMSA web site for more information: <http://hazmat.dot.gov>.

About Shipping Lithium Batteries by Air Service

There are two kinds of lithium batteries, both of which contain very high levels of energy, usually in small cases:

- Lithium ion (Li-ion) batteries, which are *rechargeable*. This type of battery includes those referred to as lithium polymer (Li-Po) batteries. Sometimes, these are also called secondary lithium batteries.
- Lithium metal batteries, which are *non-rechargeable*. These are also sometimes called primary lithium batteries.

Because lithium batteries are designed to provide high levels of power, the electrical energy in these batteries is significant, meaning that such batteries can sometimes generate a great amount of heat if short circuited. In addition, the chemical contents of these batteries may catch fire if damaged, or improperly designed or assembled. For these reasons, there are safety regulations controlling the shipment of these types of batteries. Shippers must conform to the applicable sections of the U.S. Hazardous Materials Regulations and/or international regulations such as the International Air Transport Association's *Dangerous Goods Regulations*.

While both of these types of lithium batteries are classified as *hazardous materials* (also referred to as *dangerous goods*), there are exceptions for common small sizes of these batteries that simplify the rules for shipping these items. This document describes the rules for shipping these small lithium batteries.

Lithium Metal

- Cells must not contain more than 1.0 g of lithium metal;
- Batteries must not contain more than 2.0 g of lithium metal.

Lithium Ion

- In the U.S. rules
 - Cells must not exceed 1.5 g of "equivalent lithium content";
 - Batteries must not exceed 8 g of "equivalent lithium content."

You may calculate "equivalent lithium content" by multiplying the cell's or battery's ampere-hours by 0.3. Since most small batteries are marked with milliampere-hours, you must first divide milliampere-hours by 1,000 before multiplying the result by 0.3.

- In the international rules (required outside the U.S.)
 - Cells must not exceed 20 Watt-hours;
 - Batteries must not exceed 100 Watt-hours.

You may calculate Watt-hours by multiplying ampere-hours by voltage. Since most small batteries are marked with milliampere-hours, you must first divide milliampere-hours by 1,000 before multiplying the result by the battery's voltage.

Shipments of larger batteries are not subject to the exceptions and are thus fully regulated, and must be prepared as such. UPS requires a contract for shipment of these regulated hazardous materials. Restrictions apply to the types of hazardous materials carried, and the service territory available for hazardous materials.

Note: In recent years, there have been occasional recalls of defective lithium batteries. Never send recalled lithium batteries by air; doing so can be very dangerous and may result in fines or penalties against you, the sender. In addition, UPS does not transport recycled batteries by air. UPS air services that have the potential to travel by air include: UPS Next Day Air®, UPS 2nd Day Air®, UPS 3 Day Select®, International Express and International Expedited. UPS Ground service to or from Alaska, Hawaii and Puerto Rico also must travel by aircraft for at least one flight segment, and are thus treated as air shipments.

Shipping Lithium Batteries — Without Electronic Equipment

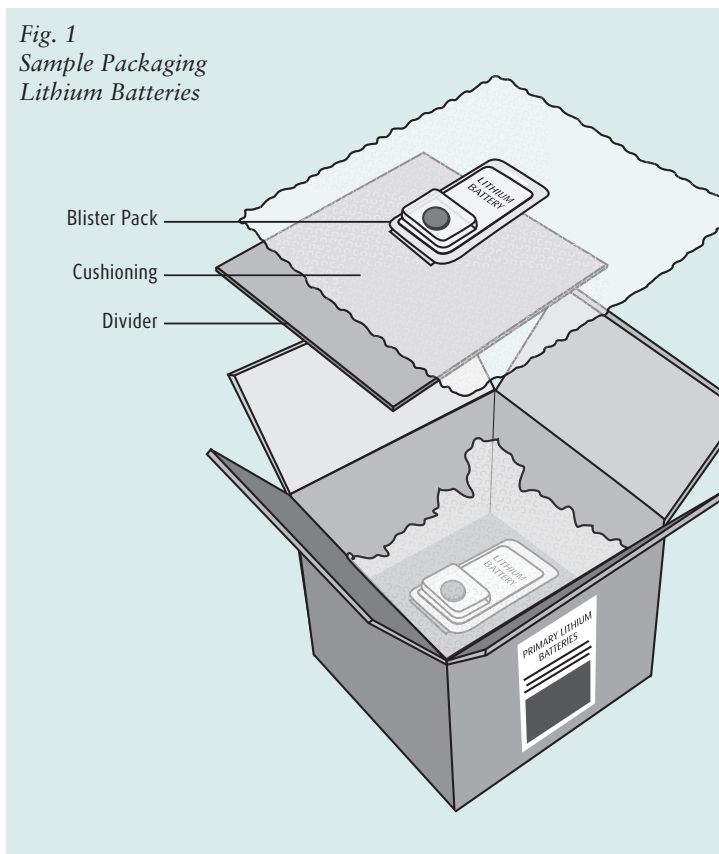
The rules for shipping small lithium batteries differ, depending on the type of battery involved. The strictest rules apply to lithium metal batteries. Regardless of the battery type, one of the most important steps in preparing any battery for shipment is to protect against short circuits.

LITHIUM BATTERIES

Short Circuit Protection

As they are packed, batteries must be protected against short circuits (see Fig. 1). There are various ways of accomplishing this protection. For example, many batteries are sold in blister packs that provide the required protection. Other options include placing single batteries into a plastic bag (without other contents), putting non-conductive tape over battery terminals, or utilizing a design that recesses terminals enough that they cannot come into contact with conductive materials or other battery terminals. Never pack metal objects or other conductive items into the same package with batteries if there is an opportunity for those objects or items to come into contact with the batteries' terminals. If it is necessary to send tools or other items with the batteries, separately contain properly protected batteries in a small box within a larger package that you use for the other items.

Fig. 1
Sample Packaging
Lithium Batteries



- **Small Lithium Metal Batteries** — The chemistry of these batteries poses great fire risks when they are short-circuited, or if they are somehow damaged. For this reason, they must never be transported aboard passenger aircraft and must be marked to warn about the contents. Whether you plan to ship these batteries by air or ground, the package must be marked with either of the two following statements (in letters at least 6 mm high for packages of up to 66 lb gross weight or 12 mm high for heavier packages):

**“PRIMARY LITHIUM BATTERIES—FORBIDDEN
FOR TRANSPORT ABOARD PASSENGER AIRCRAFT”**

—or—

**“LITHIUM METAL BATTERIES—FORBIDDEN
FOR TRANSPORT ABOARD PASSENGER AIRCRAFT”**

Packages used for battery shipments need to be rugged enough to keep the contents from being crushed. For this reason, international rules always require a package that is capable of being dropped 1.2 meters (approximately 4 feet) without breaking open or damaging the batteries. This same requirement applies in the U.S. when packages contain more than 24 lithium cells or more than 12 lithium batteries. Strictly within the U.S., the gross package weight must not exceed 30 kg (66 lb). Any international shipment must be restricted to a gross package weight of 2.5 kg (5.5 lb).

It is important to provide the necessary warnings on the outside of a package containing lithium batteries. International regulations require that any package of lithium metal batteries display a distinctive handling label (110 mm x 120 mm):



LITHIUM BATTERIES

Short Circuit Protection (cont.)

U.S. domestic packages may be marked simply with a warning that a package contains lithium batteries and that special procedures must be followed if the package is damaged. (This information is required if the package contains more than 24 cells or 12 batteries.)

There are conditions under which a document should accompany these shipments as well, stating that the package contains lithium batteries, must be handled with care and that a flammability hazard exists if the package is damaged. The document also should state that special procedures are to be followed in the event the package is damaged, to include inspection and repacking if necessary. A telephone number for additional information is to be included. The document is required for any shipment under the international regulations, and is also required for U.S. domestic shipments containing more than 24 cells or more than 12 batteries. (This document, when required, may be affixed to a UPS package in a document pouch.)

- **Small Lithium Ion Batteries** — Careful packaging also applies to shipments of rechargeable lithium batteries. These batteries do not require the marking that prohibits carriage aboard passenger aircraft.

Packages used for lithium ion battery shipments need to be rugged enough to keep the batteries from being crushed. For this reason, international rules always require a package that is capable of being dropped 1.2 meters (approximately 4 feet) without breaking open or damaging the batteries. This same requirement applies in the U.S. when packages contain more than 24 lithium cells or more than 12 lithium batteries. Strictly within the U.S., the gross package weight must not exceed 30 kg (66 lb). Any international shipment must be restricted to a gross package weight of 10 kg (22 lb).

It is important to provide the necessary warnings on the outside of a package containing lithium batteries. International regulations require that any package of lithium ion batteries display a distinctive handling label (110 mm x 120 mm):



U.S. domestic packages may be marked simply with a warning that a package contains lithium batteries and that special procedures must be followed if the package is damaged. (This marking is required if the package contains more than 24 cells or 12 batteries.)

There are conditions under which a document should accompany these shipments as well, stating that the package contains lithium batteries, must be handled with care and that a flammability hazard exists if the package is damaged. The document also should state that special procedures are to be followed in the event the package is damaged, to include inspection and repacking if necessary. A telephone number for additional information is to be included. The document is required for any shipment under the international regulations, and is also required for U.S. domestic shipments containing more than 24 cells or more than 12 batteries. (This document, when required, may be affixed to a UPS package in a document pouch.)

Lithium Batteries Packed with or Contained in Equipment

If you wish to ship a package containing a device that either has lithium batteries installed in it, or has its batteries packaged separately, there are similar safety regulations covering these types of shipments. By keeping the number of devices and batteries to a minimum, you will simplify your compliance requirements. U.S. rules become more complex when packages contain over 5 kg net weight of batteries or exceed a total of 24 cells or 12 batteries. (Guidance in this document is restricted to smaller shipments. For packages that exceed 5 kg net weight of batteries, or quantities over 24 cells or 12 batteries, you must consult the U.S. DOT Hazardous Materials Regulations, 49 CFR 172.102, Special Provision 188.)

LITHIUM BATTERIES

Lithium Metal Batteries Packed with Equipment or Contained in Equipment

- **Packed with Equipment** — The batteries, fully protected against short circuit, must be placed into a rugged inner package that fully contains the batteries. The package should contain only the number of batteries required to operate the device. (Up to two spare batteries may be packed, provided all the international requirements are followed.) Communication requirements must also be followed.

It is important to provide the necessary warnings on the outside of a package containing lithium batteries. International regulations require that any package of lithium metal batteries packed with equipment display a distinctive handling label (110 mm x 120 mm):



The package must be accompanied by a document stating that the package contains lithium batteries, must be handled with care and that a flammability hazard exists if the package is damaged. The document also should state that special procedures are to be followed in the event the package is damaged, to include inspection and repacking if necessary. A telephone number for additional information is to be included. (This document, when required, may be affixed to a UPS package in a document pouch.)

- **Contained in Equipment** — The package is simplest to ship when there are no more than 4 cells or 2 batteries contained in the package. If the package contains more than this number, the communication requirements discussed above must also be followed.

Lithium Ion Batteries Packed with Equipment or Contained in Equipment

- **Packed with Equipment** — The batteries, fully protected against short circuit, must be placed into a rugged inner package that fully contains the batteries. The package should contain only the number of batteries required to operate the device. (Up to two spare batteries may be packed, provided all the international requirements are followed.) Communication requirements must also be followed.

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- **Contained in Equipment** — The package is simplest to ship when there are no more than 4 cells or 2 batteries contained in the package. If the package contains more than this number, the communication requirements discussed above must also be followed.