



How to safely pack and ship batteries

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How to safely pack and ship batteries

Although they are very common today in portable electronics, tools and other applications, batteries can be a source of dangerous heat, sparks or fire if they are improperly packaged for shipping. For this reason, UPS® customers must follow applicable safety regulations and appropriate precautions when preparing batteries for transportation. Battery shipments may be subject to both U.S. and international safety regulations, and because of the potential dangers associated with violations of those regulations, people who do not follow the regulations when packing their shipments could be subject to fines or other penalties.

UPS has assembled this illustrative guide to help you safely pack and ship many kinds of batteries. In some cases, such as with alkaline or certain nonspillable lead-acid batteries, your responsibilities may be limited to simple steps such as: selecting strong outer packaging; carefully protecting battery terminals to prevent sparking or short circuit; and carefully preparing the interior package components to keep tools or other metal objects away from batteries.

Other types of batteries, including lithium ion and lithium metal types, also may be fully regulated as hazardous materials (also known as dangerous goods) for transportation, so that in addition to those basic safety precautions they require use of specialized packaging, specific hazard labeling, and specific documents certifying compliance with the applicable regulations.

As you review this brochure, please be aware of how your shipping practices comply with the guidance given here, and understand that some of your batteries may require you to review and comply with the *U.S. Department of Transportation (DOT) Hazardous Materials Regulations (Title 49 of the Code of Federal Regulations)* and/or the *International Air Transport Association (IATA) Dangerous Goods Regulations (DGR)*. The IATA DGR is based on the *International Civil Aviation Organization (ICAO) Technical Instructions*. Additionally, other international regulatory requirements apply, such as the *International Maritime Dangerous Goods (IMDG) Code*, and the *ADR Dangerous Goods Regulations for European Road Transport*.

Protect batteries and terminals

When shipping almost any battery, you must protect all terminals against short circuits that can result in fires.

Protect terminals by completely covering them with an insulating, non-conductive material (e.g., using electrical tape or enclosing each battery separately in a plastic bag), or packing each battery in fully enclosed inner packaging to ensure exposed terminals are protected.

- Package the batteries to keep them from being crushed or damaged, and to keep them from shifting during handling.
- Always keep metal objects or other materials that can short circuit battery terminals away from the batteries (e.g., using a separate inner box for the batteries).

Note: To prevent fire, any device with installed batteries must not turn on while in transport. Protect switches that can be accidentally activated. Even very simple devices like flashlights or rechargeable drills can generate a dangerous amount of heat if accidentally activated.

Recalled or recycled batteries

Never use Air services to ship batteries recalled by the manufacturer for safety reasons, as such shipments are prohibited by regulation (i.e., *IATA Dangerous Goods Regulations, Special Provision A154*). Also, batteries accumulated for recycling are not to be sent via Air services. UPS® services that have the potential to travel by air include: UPS Next Day Air®, UPS 2nd Day Air®, UPS 3 Day Select®, UPS Express Critical®, UPS Worldwide Express Plus®, UPS Worldwide Express®, UPS Worldwide Express Freight®, UPS Worldwide Saver® and UPS Worldwide Expedited®. UPS® Ground service between Alaska, Hawaii or Puerto Rico and the continental U.S. is unavailable for either recalled or recycled batteries, as shipments in these lanes must travel by aircraft for at least one flight segment.



Electronic items for repair

When sending equipment for repairs, such as computers and cell phones or other battery operated devices, if there is any risk that the device could overheat, it should be sent **without batteries**.

Regulatory agencies

What do the abbreviations "IATA" and "PHMSA" mean?

IATA is the International Air Transport Association. It is a global trade organization that develops commercial standards and publishes the *Dangerous Goods Regulations*, containing standards for the transport of dangerous goods by air. IATA's *Dangerous Goods Regulations* are based on the International Civil Aviation Organization (ICAO) *Technical Instructions for the Safe Transport of Dangerous Goods by Air*. ICAO is the United Nations body with jurisdiction over international aviation issues.

PHMSA is the Pipeline and Hazardous Materials Safety Administration of the U.S. Department of Transportation, which develops regulations for transport of dangerous goods by all modes within the U.S.

Types of batteries

There are a variety of batteries available today and, while in transport, many are regulated as hazardous materials (also known as dangerous goods) that may only be shipped with UPS by shippers with contracts for hazardous materials/dangerous goods service.

| ID Number | Proper Shipping Name and Description | Hazard Class |
|---------------|---|--------------|
| UN2794 | Batteries, Wet, Filled with Acid | 8 |
| UN2795 | Batteries, Wet, Filled with Alkali | 8 |
| UN2800 | Batteries, Wet, Nonspillable | 8 |
| UN3028 | Batteries, Dry, Containing Potassium Hydroxide Solid | 8 |
| UN3090 | Lithium Metal Batteries | 9 |
| UN3091 | Lithium Metal Batteries Contained in Equipment or Lithium Metal Batteries Packed with Equipment | 9 |
| UN3292 | Batteries, Containing Sodium | 4.3 |
| UN3480 | Lithium Ion Batteries | 9 |
| UN3481 | Lithium Ion Batteries Contained in Equipment or Lithium Ion Batteries Packed with Equipment | 9 |

Some of the battery types shown above may be shipped under regulatory exceptions that do not require full compliance with the hazardous materials/dangerous goods regulations. In addition, there are some battery types (e.g., conventional dry cell or alkaline batteries in consumer sizes) that are not regulated at all, provided they are adequately protected against short circuit.

While this document is designed to highlight safety practices for UPS customers who pack and ship batteries, it does not replace the applicable regulations. For more information, consult the U.S. DOT's Hazardous Materials Regulations (49 CFR). You may also consult U.S. DOT's online information at <http://hazmat.dot.gov>, or call the U.S. DOT's Hazardous Materials Information Center at 1-800-467-4922. International air shipments may additionally be subject to the Dangerous Goods Regulations of the International Air Transport Association (IATA). For more information, see <http://www.iata.org>.



Types of batteries (cont.)

Wet Batteries (UN2794 and UN2795) — Not accepted in UPS small package services; permitted in UPS Air Freight and UPS Ground Freight

These batteries are commonly used in cars, electric wheelchairs, forklifts, some continuous computer power sources and other applications. They contain highly corrosive acid or alkali and can cause fires from short circuit. All terminals must be protected against short circuit, and the batteries packaged and tested according to 49 CFR 173.159 for U.S. shipments, or IATA Section 5, *Packing Instruction 870*. Note that air shipments must include an acid- or alkali-proof liner, or include supplementary packaging with sufficient strength and adequate seals to prevent leakage of electrolyte fluid in the event of spillage (see Figs. 1 and 2). Applicable shipping paper/Declarations for Dangerous Goods requirements must be met.

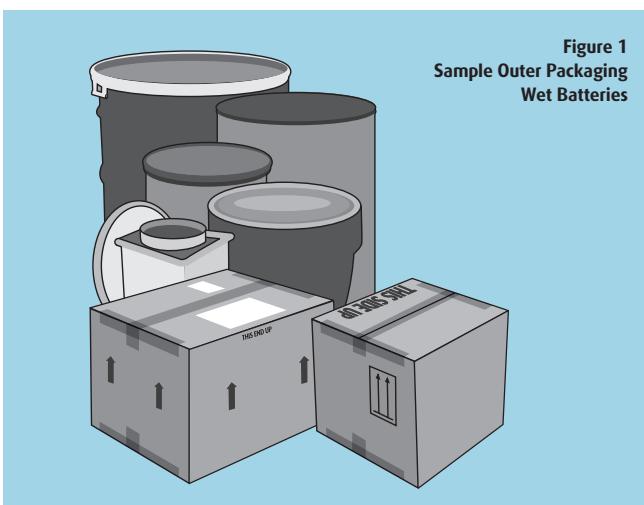
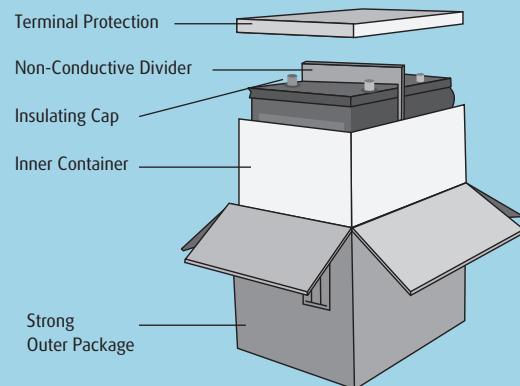


Figure 1
Sample Outer Packaging
Wet Batteries

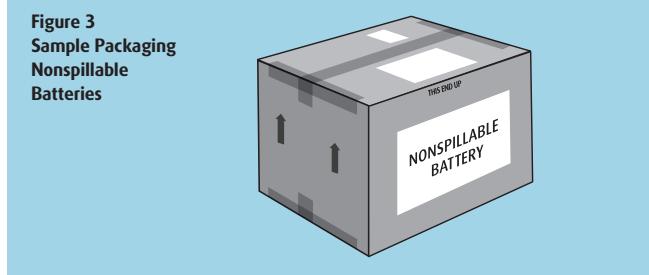
Figure 2
Sample Packaging
Multiple Wet Batteries



Shipments of nonspillable acid or alkali batteries performed under the IATA Dangerous Goods Regulations must be fully declared and conform to the requirements of *Packing Instruction 872*.

Nonspillable acid or alkali batteries that comply with certain additional testing are not subject to any regulations, provided the terminals are protected against short circuit. These additional requirements, which are stated in 49 CFR 173.159a(d) and in IATA Section 4.4, *Special Provision A67*, require that the battery contain no free-flowing liquid, and the electrolyte must not flow from a cracked case at 55°C (131°F). The battery and package should be marked "NONSPILLABLE" or "NONSPILLABLE BATTERY."

Figure 3
Sample Packaging
Nonspillable
Batteries



Nonspillable Batteries (UN2800)

These batteries may not be subject to the Hazardous Materials Regulations if they meet the pressure differential and vibration testing in 49 CFR 173.159, as well as being plainly and durably marked either "NONSPILLABLE" or "NONSPILLABLE BATTERY" on the outer packaging (see Fig. 3). Conformance with 49 CFR 173.159a is mandatory and the batteries must be prepared for transport so as to prevent short circuit and unintentional activation of any devices or equipment in the package.



Types of batteries (cont.)

Dry Batteries, Containing Potassium Hydroxide Solid (UN3028)

In the U.S., these batteries must be prepared according to *Special Provision 237 in 49 CFR 172.102*, which states that UN3028 materials "must be prepared and packaged in accordance with the requirements of 173.159(a), (b), and (c). For transportation by aircraft, the provisions of 173.159(b)(2) are applicable." International air shipments of these types of batteries must conform to *IATA Packing Instruction 871*.

Batteries, Containing Sodium (UN3292)

These batteries are not accepted in the UPS package environment.

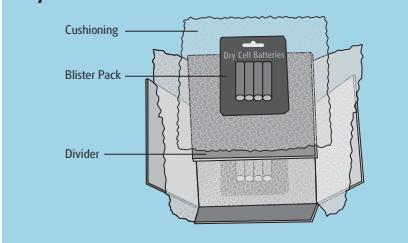
Dry Batteries, Sealed, n.o.s.

These batteries are typically used for portable power applications, are hermetically sealed and generally use metals (other than lead) and/or carbon as electrodes. They must meet all the requirements set forth in *Special Provision 130 in 49 CFR 172.102*, which includes prevention of the dangerous evolution of heat from short circuit or damage. Under *IATA, Special Provision A123* must be followed, which includes short circuit protection of exposed terminals and protection against accidental activation of the battery.

Other batteries

Although common dry cells (e.g., AA, C, D batteries) may not be regulated as hazardous materials, all batteries can cause fires from short circuit if batteries and terminals are not protected. Each battery shipment must meet all the requirements set forth in *Special Provision 130 in 49 CFR 172.102*, which includes prevention of the dangerous evolution of heat from short circuit or damage. For air packages containing dry cell batteries with a voltage (electrical potential) that exceeds nine volts, the words "Not restricted" must be marked on the package to indicate compliance with the regulations. The equivalent requirement for IATA shipments is found in *Section 4.4 of the IATA Dangerous Goods Regulations, as Special Provision A123* (see Fig. 4).

Figure 4
Sample Packaging
Dry Cell Batteries



Lithium batteries

(UN3090, UN3091, UN3480, UN3481)

Regulations applicable to shipments of lithium batteries within the United States have changed. Compliance with the new regulations is mandatory effective **February 6, 2015**.

About 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 if 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 regulations published by PHMSA and/or IATA.

While all 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. Shipments not fully regulated as dangerous goods do not require a UPS® Dangerous Goods contract.



Shipping lithium batteries by air service

Regulations differ depending upon what type of lithium battery you are shipping (lithium ion or lithium metal) and whether you are shipping batteries packed without equipment, batteries packed with equipment, or batteries contained in equipment. Please see Figure 7 (Page 8) and Figure 9 (Page 10) for additional information.

Because of changes to the IATA Dangerous Goods Regulations and ICAO Technical Instructions, shipments of lithium metal batteries without equipment are limited to the UPS International Dangerous Goods (IDG) network. Please see the origins and destinations that are authorized for IDG: <http://www.ups.com/content/us/en/resources/ship/idg/information/acl.html>.

Lithium battery types

There are two major kinds of lithium batteries, both of which contain very high levels of energy:

Lithium ion (Li-ion) batteries are rechargeable.

- Sometimes called "secondary lithium batteries"*
- Includes lithium polymer (Li-Po) batteries*
- These batteries are often found in common electronic devices such as cell phones and laptops*

Lithium metal batteries are generally non-rechargeable.

- Sometimes called "primary lithium batteries"*

Shipping lithium batteries by ground service

Additional weight and labeling requirements now apply to ground shipments of lithium batteries in the U.S. The requirements differ depending upon what type of lithium battery you are shipping (lithium ion or lithium metal) and whether you are shipping batteries packed without equipment, batteries packed with equipment, or batteries contained in equipment. Please see Figure 8 (Page 9) and Figure 10 (Page 11) for additional information.

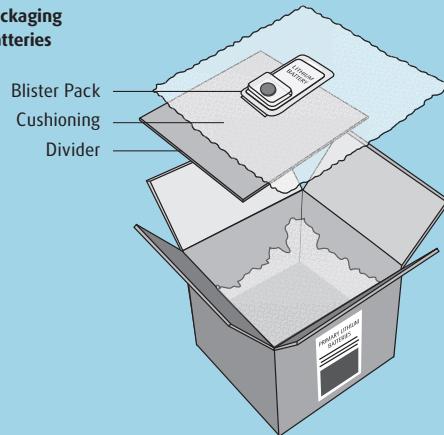
These requirements also apply to cross-border ground shipments from the U.S. to Canada and Mexico.

UPS® Ground service to or from Alaska, Hawaii, Puerto Rico and many small islands also must travel by aircraft for at least one flight segment. Shipments to or from these destinations are thus treated as air shipments.

What are some ways I can help prevent a short-circuit or activation of lithium batteries in my shipment while in transport?

A major risk of shipping lithium batteries is short-circuit of a battery or inadvertent activation while in transport. All batteries should be packed to eliminate the possibility of a short-circuit or activation (see Figure 5 for an example). Ensure no batteries can come in contact with other batteries, conductive surfaces or metal objects while in transport. IATA regulations require packing cells and batteries in fully enclosed inner packaging made of non-conductive material (e.g., plastic bags) and ensuring that exposed terminals or connectors are protected with non-conductive caps or tape or by other similar means. They also recommend securely cushioning and require packing batteries to prevent shifting during transport or loosening of terminal caps. Do not use envelopes or other soft-sided packs. Please see the IATA website for additional tips and guidance: <http://www.iata.org/lithiumbatteries>.

Figure 5
Sample Packaging
Lithium Batteries

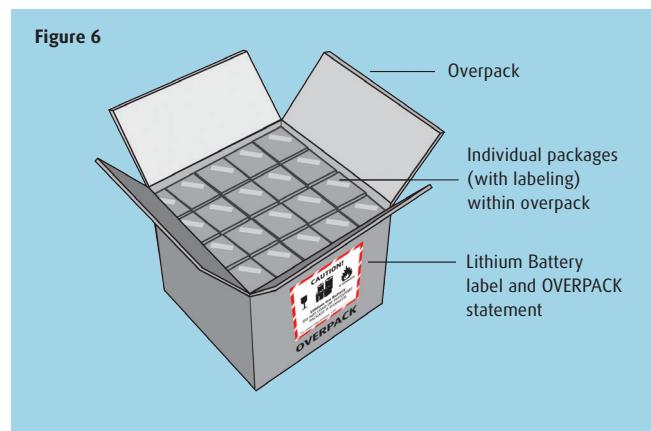




General regulations and FAQs

Do quantity limits on cells and batteries apply to the overpacks? For the purposes of the regulation, what is considered the "package"?

An overpack may be used to consolidate several packages that have been properly prepared for shipment. Provided the individual packages are in compliance with the regulations, then at this time the limits apply only to the package(s) within the overpack. However, it is required that the individual packages comply with the necessary requirements (such as the ability to withstand a 1.2 meter drop test). The overpack must be marked with the word "overpack" and labeled with the appropriate lithium battery handling label. See Figure 6 below.



What does the abbreviation "Wh" mean?

"Wh" stands for "watt-hour." It is a measure used to indicate the energy capacity of a lithium ion cell or battery.

What is a "button battery"?

A button battery is a small round battery where the height is less than the diameter¹ also commonly referred to as "coin batteries." Examples can be found in watches, calculators, electronic clocks, toys and other applications.

What is a "cell" versus a "battery" under this regulation?

- A *battery* is two or more cells electrically connected together by permanent means, including case, terminals and markings.
- **Note:** "Battery packs," "modules" or "battery assemblies" are treated as batteries under this regulation.
- A *cell* is a single encased electrochemical unit. It has one positive and one negative electrode that exhibit a voltage differential across its two terminals.¹

Note: Many cells can be termed "battery" or "single-cell battery" in common conversation, but under this regulation a single cell must use the requirements related to "cells" only. Examples of a "cell" would be a CR123 primary lithium cell used for cameras and flashlights.

Required labels and markings

Requirements for the use of the labels and markings described on the next page vary depending upon the type of battery being shipped (lithium ion or lithium metal) and how the batteries are packed (without equipment, with equipment, or contained in equipment).

See pages 8 and 10 for how and when these labels and markings must be used for air shipments, as required by U.S. DOT regulations. See pages 9 and 11 for labeling and marking requirements for ground shipments.

Required documentation

Many shipments must be accompanied by documentation identifying the battery type (which may be affixed to a UPS® package in a document pouch) that must also state the following:

- The package must be handled with care because a fire hazard exists if it is damaged
- Special procedures are to be followed if the package is damaged, to include inspection and repacking if necessary
- A telephone number for additional information

¹ Source: "IATA Lithium Battery Guidance Document: Transport of Lithium Metal and Lithium Ion Batteries." IATA. 2014. Web. <http://www.iata.org/lithiumbatteries>



Required labels and markings (cont.)

Distinctive handling label (Lithium Ion Batteries)

This label must be at least 110 mm × 120 mm and be on the outside of a package containing lithium ion batteries. For smaller packages that can only bear smaller labels, the label dimensions may be 105 mm wide × 74 mm high.



Distinctive handling label (Lithium Metal Batteries)

This label must be at least 110 mm × 120 mm and be on the outside of a package containing lithium metal batteries. For smaller packages that can only bear smaller labels, the label dimensions may be 105 mm wide × 74 mm high.



Cargo Aircraft Only markings

If you plan to ship lithium metal batteries packed without equipment by air or ground in the U.S., the package must be marked or labeled to show that it may not be transported on passenger aircraft. You may use the Cargo Aircraft Only label shown on this page or either of the two following statements, in letters at least 6 mm high:

**"PRIMARY LITHIUM BATTERIES—
FORBIDDEN FOR TRANSPORT
ABOARD PASSENGER AIRCRAFT"**

—or—

**"LITHIUM METAL BATTERIES—
FORBIDDEN FOR TRANSPORT
ABOARD PASSENGER AIRCRAFT"**

Air shipments with a destination outside the U.S. must always display the Cargo Aircraft Only label shown below.



Labels and markings for ground shipments

Ground shipments must display a marking that identifies the presence of lithium ion or lithium metal batteries and that states the following:

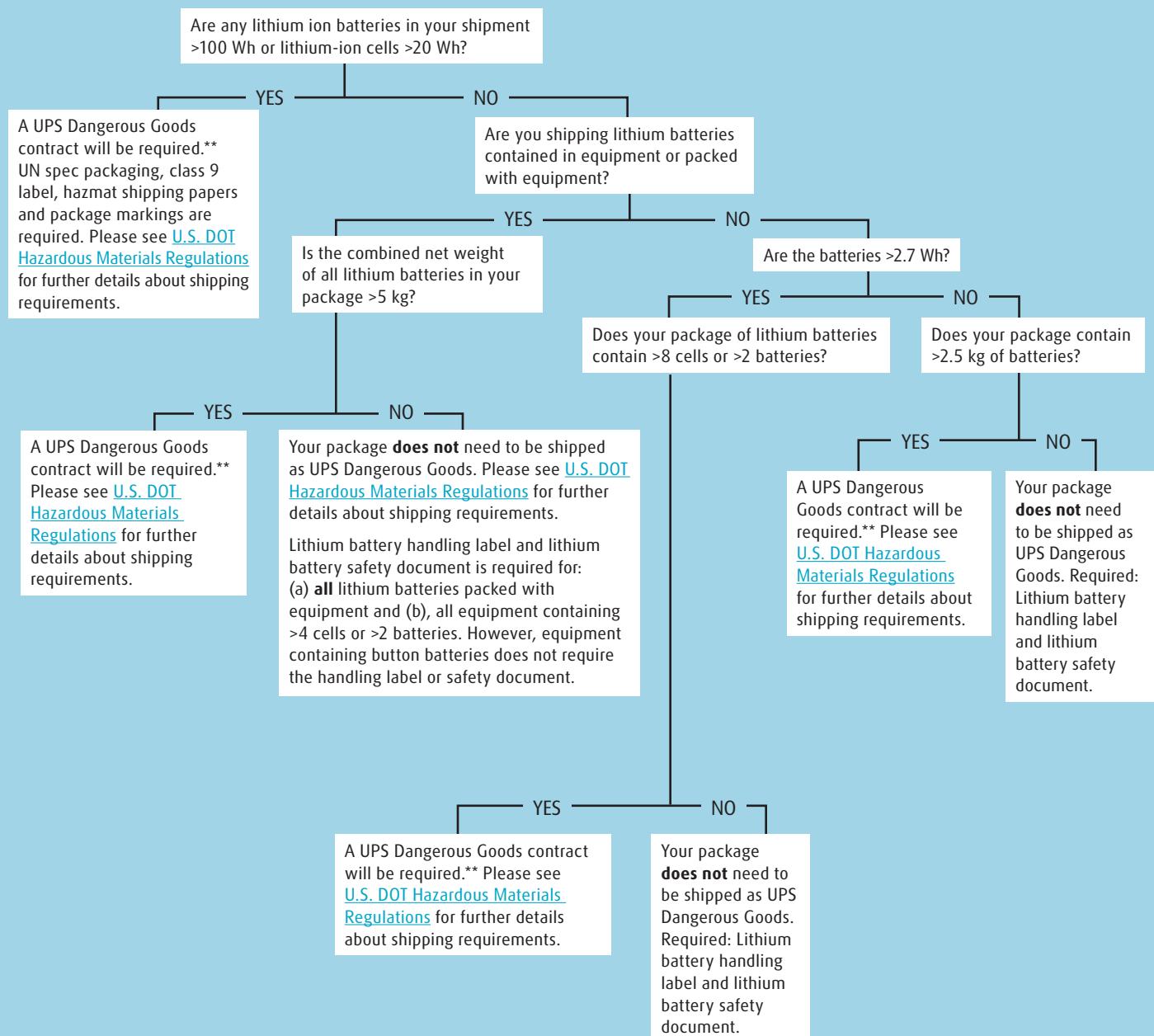
- The package must be handled with care because a fire hazard exists if it is damaged
- Special procedures are to be followed if the package is damaged, to include inspection and repacking if necessary
- A telephone number for additional information

The distinctive handling labels (shown on this page) may be used. Other stickers or markings may be used, but they must provide all the required information.



Figure 7
Air Shipments of Lithium Ion Batteries*

Is my Lithium Ion Battery air shipment fully regulated, requiring UPS® Dangerous Goods service?



*Packaging for **all** shipments of lithium batteries must be able to withstand a 1.2 meter drop test, and all batteries must be packed to eliminate the possibility of a short-circuit or activation. Do not use envelopes or any other soft-sided packs. Please see page 5 for more information.

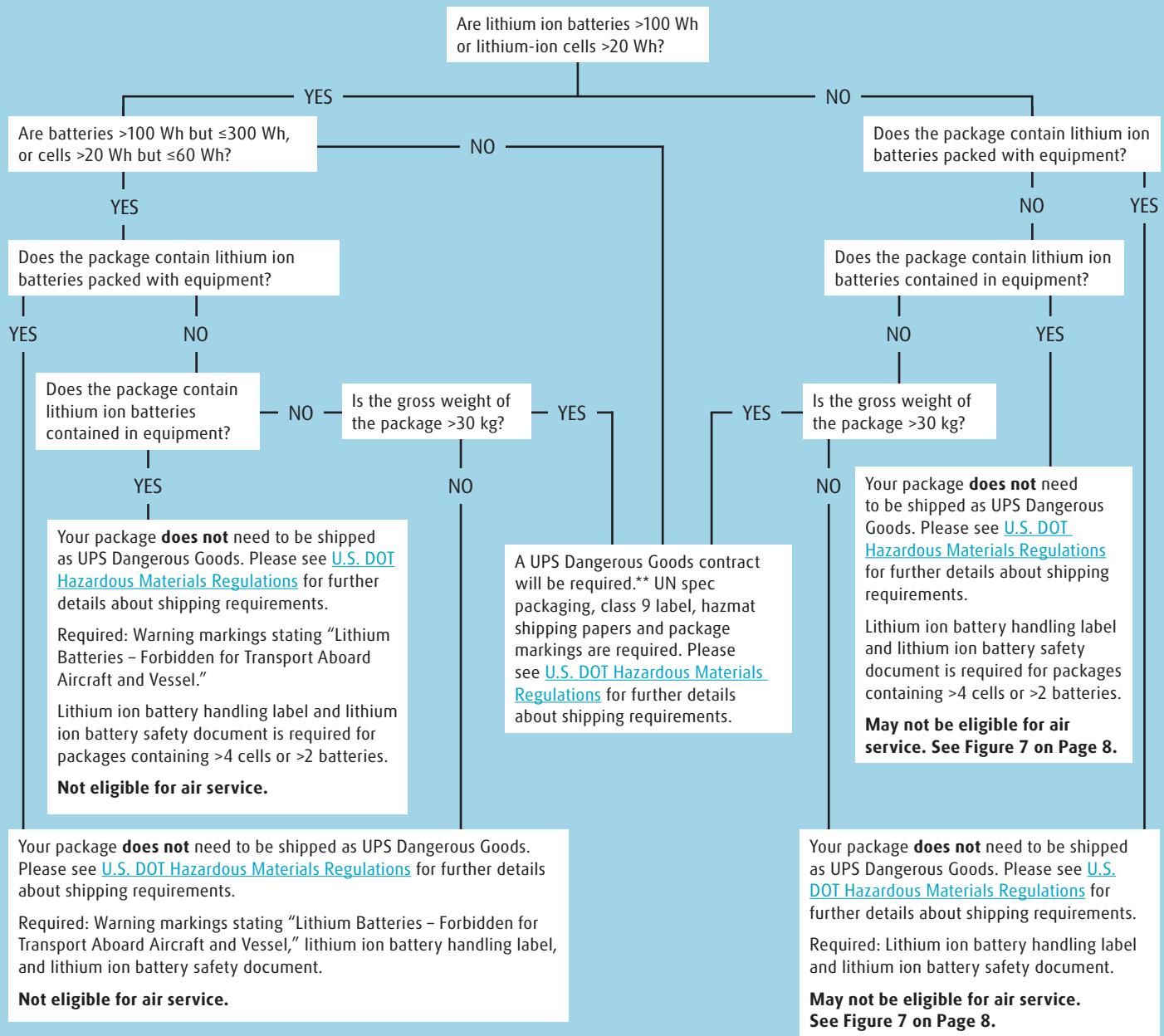
**Contracts are required for UPS® Small Package and UPS Air Cargo® services but not UPS® Air Freight hazmat shipments; please contact your customer representative for details.



Figure 8
Ground Shipments of Lithium Ion Batteries*

Is my Lithium Ion Battery ground shipment fully regulated, requiring UPS® Dangerous Goods service?
(For detailed information about required documentation and labeling noted below, please see Page 7.)

Note: Ground shipments of lithium batteries must not be sent to any address in Alaska, Hawaii, Puerto Rico, or destinations on islands such as Avalon, CA.



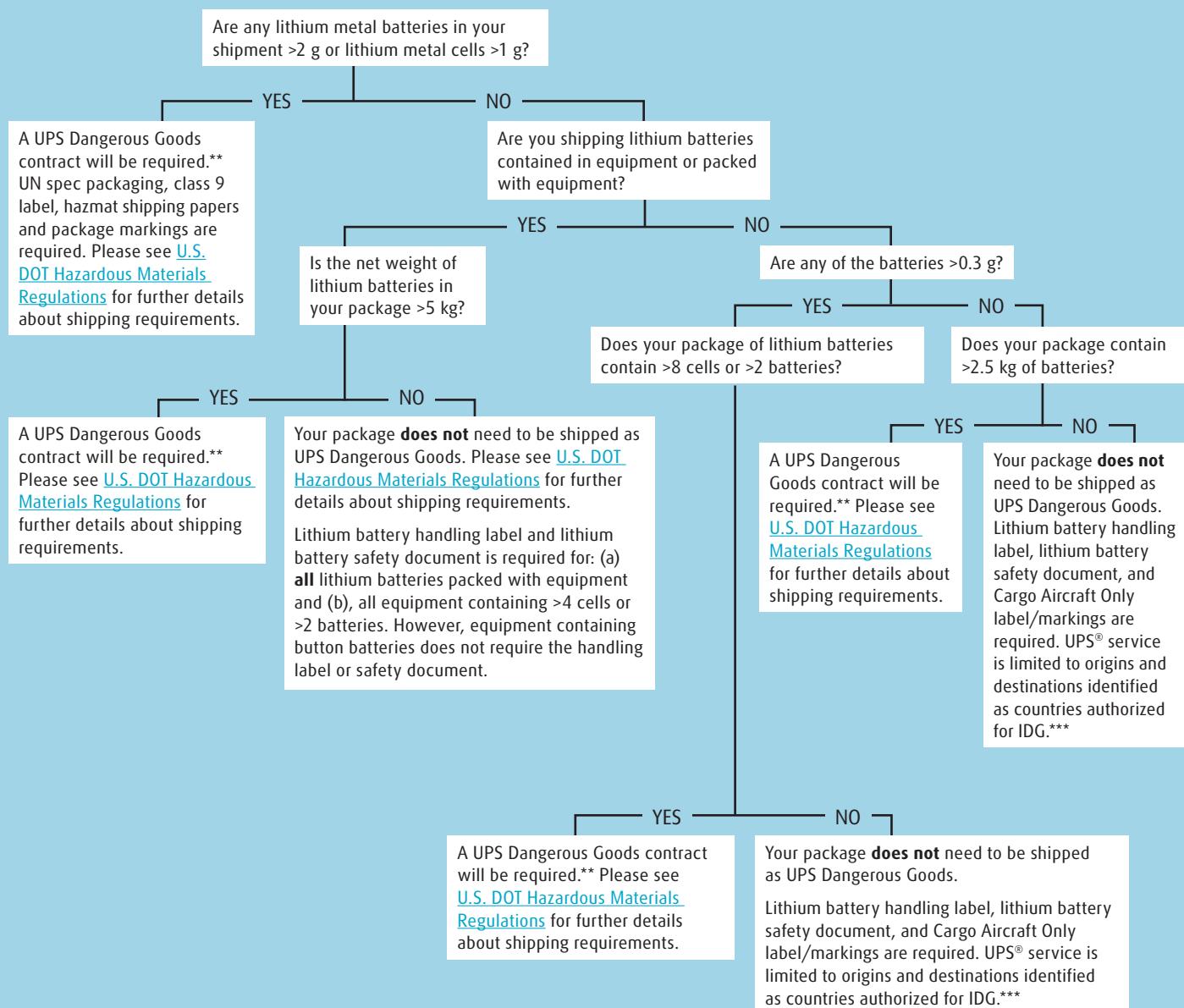
*Packaging for all shipments of lithium batteries must be able to withstand a 1.2 meter drop test, and all batteries must be packed to eliminate the possibility of a short-circuit or activation. Do not use envelopes or any other soft-sided packs. Please see page 5 for more information.

**Contracts are required for UPS® Small Package and UPS Air Cargo® services but not UPS® Air Freight hazmat shipments; please contact your customer representative for details.



Figure 9
Air Shipments of Lithium Metal Batteries*

Is my Lithium Metal Battery air shipment fully regulated, requiring UPS® Dangerous Goods service?



*Packaging for **all** shipments of lithium batteries must be able to withstand a 1.2 meter drop test, and all batteries must be packed to eliminate the possibility of a short-circuit or activation. Do not use envelopes or any other soft-sided packs. Please see page 5 for more information.

**Contracts are required for UPS® Small Package and UPS Air Cargo® services but not UPS® Air Freight hazmat shipments; please contact your customer representative for details.

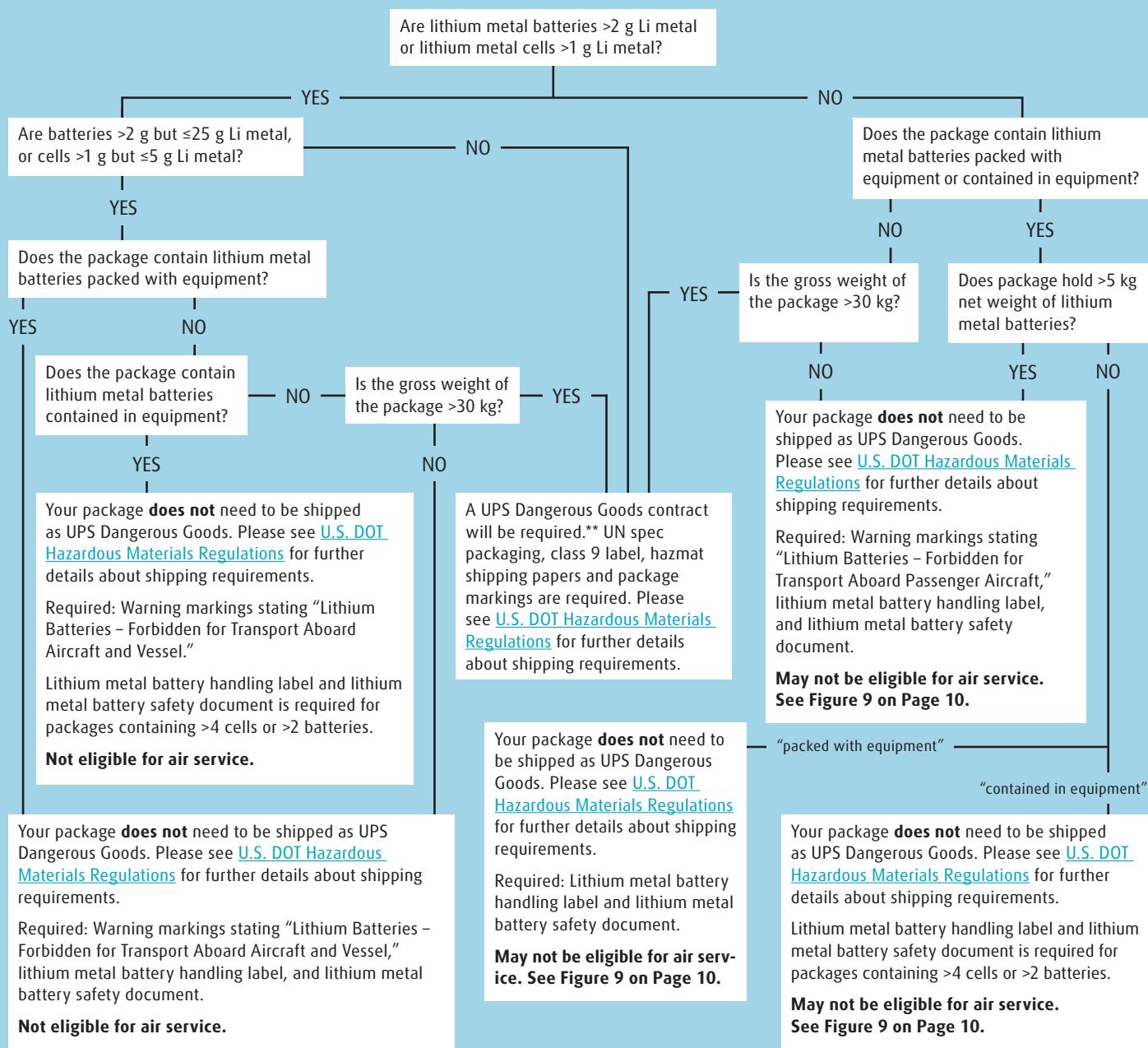
***Visit <http://www.ups.com/content/us/en/resources/ship/idg/information/acl.html> for a list of countries approved for IDG.



Figure 10
Ground Shipments of Lithium Metal Batteries*

Is my Lithium Metal Battery ground shipment fully regulated, requiring UPS® Dangerous Goods service?
(For detailed information about required documentation and labeling noted below, please see Page 11.)

Note: Ground shipments of lithium batteries must not be sent to any address in Alaska, Hawaii, Puerto Rico, or destinations on islands such as Avalon, CA.



*Packaging for all shipments of lithium batteries must be able to withstand a 1.2 meter drop test, and all batteries must be packed to eliminate the possibility of a short-circuit or activation. Do not use envelopes or any other soft-sided packs. Please see page 5 for more information.

**Contracts are required for UPS® Small Package and UPS Air Cargo® services but not UPS® Air Freight hazmat shipments; please contact your customer representative for details.