

Shipping Batteries Safely: What You Need to Know

Batteries are an everyday staple of American life. From mp3-players and notebook computers, to motorized wheelchairs and cordless tools, batteries are everywhere.

Most batteries are considered hazardous materials (also called *dangerous goods*), and are subject to regulations issued by the U.S. Department of Transportation (DOT), and International Civil Aviation Organization (ICAO). The U.S. DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) works to ensure the safe transportation of hazardous materials – including batteries – shipped by highway, rail, water, or air.

If you are using a carrier such as FedEx, DHL, or UPS, find out which regulations they require their customers to comply with.

Whichever regulations you follow, their purpose is to protect the safety of people and property. Batteries have the potential to short-circuit, which can lead to fires. Some batteries contain corrosive liquid, which can injure people or damage property. If the appropriate regulations and packaging requirements are not followed, these shipments may cause a variety of problems during transport. In addition, failure to comply with these regulations or packaging requirements may result in a fine or even jail time.

PHMSA prepared this brochure with the help of industry partners to assist you in safely packaging batteries for transport. Whether you are shipping a single battery for a notebook computer, or a pallet load of D-cells for flashlights, the safety of your package, and of the people who handle it along the way, depends on these precautions.

Fig. 1
UN SPECIFICATION
PACKAGING

All metal containers must incorporate an acid/alkali leak-proof liner adequately sealed to prevent leakage in the event of a spill.

Wet Batteries:

UN2794 – Batteries wet filled with acid, electric storage.

UN2795 – Batteries wet filled with alkali, electric storage.

Class 8 Corrosive hazardous materials

Packaging Requirements:

Outer packaging must be UN Specification Packaging, as pictured in Fig. 1 on page ___. These containers must incorporate an acid/alkali leak-proof liner adequately sealed to prevent leakage in the event of a spill. When shipping by air, include absorbent material, if required, in the event electrolyte spills from battery.

Securely fasten the batteries with the fill openings and vents facing upward. This will prevent short-circuiting and spilling of battery electrolyte. Orientation arrow markings must be on the outside of the packaging and pointing up. The words "This End Up" or "This Side Up" may be displayed on top of the package.

Packaging Requirements:

Securely pack in strong outer packaging. Be sure to protect against short-circuiting by positioning batteries side-by-side.

Non-Conductive Divider
Inner Container
Sturdy Outer Container

Fig. 2

Sample Packaging:
Multiple Wet Batteries

Nonspillable Batteries

UN2800 – Batteries, wet, nonspillable
Class 8 Corrosive hazardous material

You may regard nonspillable wet electric storage battery as not subject to the U.S. or international hazardous materials regulations, if:

- the battery meets certain testing and specification requirements,
- the battery and its outer packaging are plainly and durably marked "NONSPILLABLE" or "NONSPILLABLE BATTERY", and
- the battery is packed in such a way as to prevent short circuits.

These requirements can be found in 49 CFR §173.159(d) (U.S. hazardous materials regulations) and the ICAO Technical Instructions, Packing Instruction 806 and Special Provision A67. When shipping a nonspillable battery or a nonspillable battery contained in or packed with equipment, it is important to check the regulations carefully to be sure all of the requirements of the regulations have been met.

Lithium Batteries

UN3090 Lithium batteries (including Lithium ion batteries)
UN3091 Lithium batteries packed with or contained in equipment
Class 9 Miscellaneous hazardous materials

Regulations.

The U.S. and international regulations pertaining to the transportation of lithium (metal) cells and batteries and lithium ion cells and batteries have changed significantly over the past five years. Tests based on UN Manual of Tests and Criteria must be performed as identified in 49 CFR §173.185 and the ICAO Technical Instructions, Packing Instruction 903, and Special Provision A45. The regulations also apply to cells and batteries that are packed with or contained in equipment (UN3091).

Most consumer-type lithium metal batteries and lithium ion batteries do not require fully regulated markings, labels, and shipping papers. However, the ICAO Technical Instructions contain limited marking, shipping paper, and packaging requirements for packagings that contain more than 12 batteries or 24 cells. Larger cells and batteries must be shipped as fully regulated hazardous materials. This means that shippers of larger cells and batteries must comply with specific labeling, marking, packaging, shipping paper, and employee training requirements.

The U.S. DOT hazardous materials regulations prohibit the transport of lithium metal batteries on passenger-carrying aircraft. In addition, the U.S. DOT requires specific markings on packagings that contain small, consumer-type lithium metal batteries ("PRIMARY LITHIUM BATTERIES – FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT"). A "cargo aircraft only"

label must be placed on packagings containing larger cells and batteries that are shipped as fully regulated hazardous materials.

Some Safe Packaging Practices for Lithium Metal Batteries and Lithium ion Batteries:

Fully enclose individual batteries in plastic blister wrap, fiberboard or other inner packaging. This will protect the terminals on each battery and cell from coming in contact with other battery or cell terminals, or any item that is capable of conducting electricity that could lead to a short circuit. A form-fitting “store packaging” blister pack is acceptable, even if it encloses multiple cells and batteries.

Contact the hazardous materials or dangerous goods office of the carrier you plan to use, such as UPS, FedEx, or DHL. Certain carriers will require you to certify that you have complied with the U.S. or international hazardous materials regulations.

Fig. 3

Sample Packaging:

ICAO A45 Special Provision
Package Lithium Battery in Blister Pack Cushioning Divider Sturdy Outer Container

Fig. 4

Sample Packaging:

Fully Regulated UN3090
Cushioning
Lithium Batteries Individually Packaged
UN Specification Packaging
Sample of Lithium Metal Battery
(Prior to Packaging)

Fig. 5

Sample Packaging:

Multiple Lithium Batteries
Non-Conductive Divider
Cushioning
Sturdy Outer Container

Fig. 6

Improper Packaging:

- Missing Protective Covers
- Missing Non-Conductive Divider
- Missing Cushioning

Battery Short-Circuit

Batteries may overheat or catch fire if the terminals are short-circuited. Protect terminals from foreign objects and freight.

Fig. 7

Example of a typical battery incident

Lithium Metal Battery and Lithium ion Battery Safety Issues:

Lithium metal batteries and lithium ion batteries are used in everything from flashlights to pacemakers to cell phones and notebook computers. They also are used extensively by the military and in products such as electric vehicles and scooters. These batteries provide more energy and provide a much longer operating life than most other battery chemistries. They have the potential to generate a significant amount of heat and catch fire if damaged, improperly packaged, or not carefully designed.

Battery manufacturers are aware of these issues and design safety features into the cells and batteries. Likewise, packaging manufacturers design packaging to protect the cells and batteries from damage during transport.

Packaging:

Fully enclose individual batteries in plastic blister wrap, pasteboard, or other inner packaging that will protect each battery from making contact with another battery or any item that is capable of short-circuiting (example: multiple batteries enclosed in a single, form-fitting “retail ready”, blister pack).

Recalled or Defective Batteries and Electronic Equipment

Carefully follow the manufacturer’s instructions for packaging the battery or electronic equipment. Equipment must be in the off mode while being shipped. If the equipment being returned has the battery removed but included within the same outer package, the battery must be securely packaged. Additional information on packaging and shipping recalled batteries or electronic equipment may be obtained from the manufacturer or the Consumer Product Safety Commission (www.cpsc.gov).

Dry Cell Batteries:

These are the sealed, non-vented batteries that are normally used in flashlights or small appliances. Examples include alkaline, nickel metal hydride, and carbon zinc batteries.

Fig. 8

Sample Packaging:

Dry Cell Batteries

- Cushioning
- Divider

Fig. 9

Improper Packaging:

Loose batteries can cause dangerous short-circuit

Additional Requirements:

- Leave devices in the off position.
- Properly cushion items to prevent movement.
- Place contents in a sturdy outer container.

Packaging Requirements:

Pack these batteries securely side-by-side, in order to prevent movement or dangerous short-circuit.

This brochure is in no way intended to replace the training requirement mandated by the U.S. hazardous materials regulations (49 CFR) and ICAO Technical Instructions. This is for information purposes only. Refer to the 49 CFR and ICAO Technical Instructions for more comprehensive information.

For more information call the Hazardous Materials Info-Line at 1-800-467-4922, visit our web site at <http://hazmat.dot.gov>, or e-mail us at training@hazmat.dot.gov.

For information on safe carriage of batteries and battery-powered devices during travel, visit <http://SafeTravel.dot.gov>.

To comment on hazardous materials publications in progress, please visit our website <http://hazmat.dot.gov/HMpubsreview/>, and check back frequently to review new hazardous materials training products under development.