



Transportation of Dangerous Goods



DID YOU KNOW THAT LITHIUM BATTERIES ARE DANGEROUS GOODS?

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Lithium batteries are dangerous goods, much like gasoline, propane, and sulphuric acid.

In Canada, the shipping and importing of lithium batteries¹ are subject to the Transportation of Dangerous Goods (TDG) Act, 1992 and its Regulations.

Lithium batteries are used in many electronic devices such as cameras, cell phones, laptop computers, medical equipment and power tools.

When you ship or import lithium batteries, including those **contained in** or **packed with** devices and equipment, you **must** meet shipping requirements and declare package contents to postal carriers, couriers or transport companies.



Cause for Concern

While most lithium batteries are safe, some have overheated and caught fire. Once ignited, they can cause any nearby batteries to overheat and catch fire. These fires are difficult to put out and produce toxic and irritating fumes.

When shipping lithium batteries, it is not always clear which mode of transport will be used. Your shipment may end up on an aircraft, and an aircraft's fire suppression system may be unable to extinguish all types of lithium battery fires.

¹ In this document, the term lithium batteries is used to refer to both lithium ion and lithium metal batteries.

Counterfeit and no-brand lithium batteries are also of concern, because they may not have been safety tested. These lithium batteries may be poorly designed, have little protection, or contain manufacturing flaws.

Recent reports of incidents involving the failure of lithium batteries include:

- Computer batteries have heated up and caused fires on cargo and passenger aircraft.
- A charging lithium ion battery exploded on a mini-submarine designed to carry U.S. Navy SEALs to shore.
- A passenger's camera batteries began smoking at the boarding gate.
- Two large battery packs in a checked baggage began smouldering. The bag burst into flames when an airline agent picked it up.
- During a flight, crew found a flashlight's counterfeit lithium metal battery overheating and giving off a strong odour. The damaged battery burned the inside of the flashlight.

Definitions

What is the difference between a “cell” and a “battery”?

A **cell** is a single encased electrochemical unit (one positive and one negative electrode) with a voltage differential across its two terminals.



- Did you know that AA batteries and AAA batteries are actually cells?

A **battery** is two or more cells that are electrically connected together and fitted with devices such as a case, terminals, marking and protective devices that it needs to function properly.



- Did you know that battery packs, modules or battery assemblies manufactured to provide a source of power to another piece of equipment are treated as batteries?

What is the difference between a “lithium metal battery” and a “lithium ion battery”?

A **lithium metal battery** (primary) is usually non-rechargeable, contains metallic lithium and features a higher energy density than other non-rechargeable batteries. Lithium metal batteries are often used in calculators, pacemakers, remote car locks and watches, to name a few.

A **lithium ion battery** (secondary) is rechargeable, does not contain metallic lithium and features high energy density. A lithium polymer battery is considered a type of lithium ion battery. Lithium ion batteries are used in consumer products such as cell phones, electric vehicles, laptop computers, power tools and tablets.

What is the difference between “contained in equipment” and “packed with equipment”?

A lithium ion or metal battery **contained in equipment** means that the battery is fitted or joined to the actual device. Examples include a calculator, laptop computer or watch—with an integrated lithium battery.



A lithium ion or metal battery **packed with equipment** is not fitted or joined to the device. An example would be a power tool packed alongside a spare battery.



Short Circuit Protection

Preventing lithium batteries from short circuit is very important to keep them from overheating and catching fire. Always keep lithium batteries isolated from metal objects (e.g. jewellery, keys) or other conductive materials by enclosing each one separately and insulating terminals with a non-conductive material (e.g. electrical tape). Pack them so they cannot shift during transport.

A lithium battery inside equipment is protected from short circuit because it is secured in the actual device and cannot move around during transport. Make sure no switches or power buttons can be accidentally turned on during transport.

Watt-hour (Wh) Rating

The Wh indicates the amount of energy contained in a lithium battery. TDG Regulations regulate lithium ion batteries based on their Wh rating.



How do I calculate the Wh rating?

The Wh rating must appear on the battery case if it was made on or after January 1, 2009. If it is not there, you can calculate the Wh rating by using one of these formulas:

1. If you know the nominal voltage (V) and the capacity in ampere-hours (Ah), then
Wh = (V) x (Ah); or
2. If you know the nominal voltage (V) and the capacity in milliampere-hours (mAh), then
Wh = (V) x (mAh ÷ 1000).

If you are still not sure what your lithium battery's Wh rating, contact its manufacturer.

How do I calculate the lithium content?

You can calculate the lithium content, in grams (g), of a lithium metal cell:

1. If you know the battery's capacity in ampere-hours (Ah), then
Grams (g) lithium metal = (Ah) x 0.3; or
2. If you know the capacity in milliampere-hours (mAh), then
Grams (g) lithium metal = (mAh ÷ 1000) x 0.3.

To calculate the lithium content of the battery, simply multiply the grams (g) of lithium metal by the number of cells in the battery.

Shipping and Importing Lithium Batteries

Transport Canada regulates the safe handling, offering for transport, transporting and importing of lithium batteries by specifying classification, documentation, labelling, packaging and training requirements.

All designs and types of lithium batteries must meet the requirements of the UN Manual of Tests and Criteria to be shipped safely.

Shippers and importers must meet the requirements set out in the TDG Regulations for the handling, offering for transport, transporting and importing of lithium batteries in Canada. The requirements vary by mode of transport.

Aircraft

Domestic Transport	International Transport
<p>When shipping lithium batteries within Canada by aircraft, the TDG Regulations let you:</p> <ol style="list-style-type: none"> 1. Comply with the latest International Civil Aviation Organization (ICAO) Technical Instructions and some additional requirements of the TDG Regulations; <p>OR</p> <ol style="list-style-type: none"> 2. Use the alternative requirements listed under sections 12.10, 12.12, 12.13, 12.14 or 12.17 when the ICAO Technical Instructions limit or restrict the quantity or type of dangerous goods that you can transport. 	<p>When shipping or importing lithium batteries internationally by aircraft, Part 12 of the TDG Regulations requires you to comply with the ICAO Technical Instructions and some additional requirements of the TDG Regulations.</p>
<p>Please see Part 12 of the TDG Regulations to learn more.</p>	

Vessel (Ship)

Domestic Transport	International Transport
When shipping lithium batteries within Canada by vessel, Part 11 of the TDG Regulations requires you to comply with the TDG Regulations only.	When shipping lithium batteries internationally by vessel or by vessel not on a domestic voyage, Part 11 of the TDG Regulations requires you to comply with the International Maritime Dangerous Goods Code and some additional requirements in the TDG Regulations.
Please see Part 11 of the TDG Regulations to learn more.	

Importing

When importing lithium batteries, you must comply with the TDG Regulations. The TDG Regulations specify requirements for classification, documentation, labelling, packaging and training. You must declare them to postal carriers, couriers or transport companies.

Make sure that the lithium batteries in your shipment are not counterfeit before importing them into Canada. Buy lithium batteries from a reputable manufacturer or distributor that has documented proof that the batteries have been tested and meet the UN Manual of Tests and Criteria. You are also required to have a proof of classification, which is further explained in section 2.2.1 of the TDG Regulations.

Damaged, Defective, Recalled or Recycled Lithium Batteries

It is **FORBIDDEN** to ship damaged, defective, recalled or recycled lithium batteries by **aircraft**. This ban applies whether or not these lithium batteries are contained in equipment.

Useful Information

How can I be sure that my lithium batteries are well designed and tested?

Lithium batteries are subject to rigorous testing according to the UN Manual of Tests and Criteria. If a lithium battery does not meet the conditions, then the manufacturer must correct any failures and have it retested. This ensures a higher level of safety for design deficiencies or flaws.

The UN Manual of Tests and Criteria lists eight tests. Required tests vary depending on the type and design of lithium battery.

Test Name	Purpose of Test	Test Requirements Met If:
1. Altitude simulation	To simulate air transport under low-pressure conditions	There is no mass loss, no leakage, no venting, no disassembly, no rupture and no fire; and if the open circuit voltage of each test cell or battery after testing is not less than 90% of its voltage immediately before this procedure. The voltage requirement does not apply to test cells and batteries at fully discharged states.
2. Thermal test	To assess cell and battery seal; to confirm integrity and internal electrical connections	
3. Vibration	To simulate vibration during transport	
4. Shock	To simulate possible impacts during transport	
5. External short circuit	To simulate an external short circuit	The external temperature does not exceed 170°C and there is no disassembly, no rupture and no

Test Name	Purpose of Test	Test Requirements Met If:
6. Impact / Crush	To simulate an impact	fire within six hours of this test.
7. Overcharge	To evaluate the ability of a rechargeable battery to withstand an overcharge condition	There is no disassembly and no fire within seven days of the test
8. Forced discharge	To evaluate the ability of a rechargeable cell to withstand a forced discharge condition	

- Did you know that when you interconnect or assemble tested cells, you must also test the resulting battery?
- Did you know that lithium batteries that have been altered must be retested, even if the batteries were tested before the alteration?

What should I look for when buying lithium batteries?

Always buy lithium batteries from a reputable manufacturer or distributor that has documented proof that the batteries have been tested and meet the UN Manual of Tests and Criteria.

Know what you are accepting for transport

Always be aware of what you are accepting. You should know if there are lithium batteries in the package for shipment, contained in the equipment or packed with the equipment.

Declare your Lithium Batteries

Remember that regardless of the mode you are using to ship your lithium batteries, your shipment may end up on an aircraft, so prepare your shipment accordingly. Otherwise, you should specify that the shipment of batteries is for **ground transport only**.

As a passenger, may I carry lithium batteries on an aircraft?

Yes, you should carry spare lithium batteries or lithium batteries contained in equipment – like your cell phone, laptop or tablet – with you in your carry-on baggage. For larger items containing lithium batteries, such as mobility aids or medical equipment, you should contact your air carrier for further details.

Important Notes:

- You must insulate the terminals to protect lithium batteries from short circuit.
- Do not leave spare lithium batteries loose in your bag.
- Never pack spare lithium batteries into your checked baggage.
- Check with your air carrier if you plan on carrying lithium batteries contained in equipment in your checked baggage.
- Never carry or check damaged lithium batteries onto an aircraft.

