Transportation Regulation FAQs for Lithium and Lithium Ion Cells and Batteries

This document is intended to provide some general guidance to questions we frequently receive related to shipment of Lithium and Lithium Ion cells and batteries, as well as products being shipped with batteries and cells, or containing batteries and cells. For more detailed information about your specific situation, please contact us.

What are the regulations that govern the transport of Lithium and Lithium Ion cells and batteries?

The governing organization for the transport of Lithium and Lithium Ion cells and batteries (cells and batteries) varies based on the shipping method and region(s).

- **Air transport (domestic and international)** – Shipments of cells and batteries by air are governed by the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA). ICAO has Technical Instruction for the shipment of Dangerous Goods, and IATA has a corresponding Dangerous Goods Regulations.

- **Sea transport** – Shipments by sea are regulated by the International Maritime Dangerous Goods (IMDG), which parallel the air transport regulations.

- **Transportation within the US (vehicle, air and vessel)** – Shipments within the United States are additionally regulated by the US Department of Transportation through the Code of Federal Regulations, CFR 49 (Sections 100-185), through the U.S. Hazardous Materials Regulations (HMR).

- **Transportation within other countries** – Other countries, such as China, have specific regulations for the shipment of Lithium and Lithium Ion cells and batteries and should be investigated individually.

What are the current transportation regulations in the U.S.?

Transport of cells and batteries within the U.S. is regulated through 49 CFR Sections 100-185 of the U.S. Hazardous Materials Regulations (HMR). Specifically, Section 173.185 and the special provisions in Section 172.102 apply to Lithium and Lithium Ion cells and batteries. These sections include information on packaging for shipping, package weight limits, required testing, and exceptions that
may apply. The U.S. regulations are based on the mass of lithium in the anode of lithium cell and battery, and based on equivalent lithium content for Lithium Ion cells and batteries. The table below outlines the shipping regulations currently in effect for the U.S.

<table>
<thead>
<tr>
<th>Primary Cells and Batteries Lithium Content Limits (Cell/Battery)</th>
<th>Secondary Lithium Ion Cells and Batteries Equivalent Lithium Content Limits (Cell/Battery)</th>
<th>Battery Size</th>
<th>Shipping Classification</th>
<th>Special Packaging/Markings Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1.0 g/ ≤2.0 g</td>
<td>≤1.5 grams/ ≤8.0 grams</td>
<td>Small</td>
<td>Excepted</td>
<td>Yes³</td>
</tr>
<tr>
<td>Between 1g and 5g/ Between 2g and 25g</td>
<td>Between 1.5g and 5g/ Between 8g and 25g</td>
<td>Medium</td>
<td>Class 9⁴</td>
<td>Yes⁴</td>
</tr>
<tr>
<td>&gt;5.0 g/ &gt;25.0 g</td>
<td>&gt;5.0 g/ &gt;25.0 g</td>
<td>Large</td>
<td>Class 9</td>
<td>Yes⁵</td>
</tr>
</tbody>
</table>

Notes:
1 – Equivalent Lithium Content (ELC) = 0.3 x rated capacity (Ah) x # of cells (for packs)
2 – The sizes noted here are based solely on U.S. DoT definitions in 49CFR. These are not the same as ICAO/IATA size definitions, or UN Manual of Tests size definitions.
3. – Packages containing more than 12 batteries or 24 cells must meet certain packaging, marking and shipping paper requirements.
4 – Must be shipped as Class 9 hazardous materials unless transported by motor vehicle or rail.
5 – Requires Class 9 markings, label, specified packaging and appropriate shipping papers.

All of these regulations apply not only to cells and batteries alone, but to end product shipped with these types of cells and batteries, as well as end products containing these types of cells and batteries. Another important note is that, with a very limited set of exceptions, no Lithium or Lithium Ion cells or batteries may be introduced for transport in any mode without first completing testing in accordance with the UN Manual of Test and Criteria. Exceptions to this include shipping of prototypes for testing and waste batteries. [U.S. HMR website](https://www.hazmatmirror.com).

**What are the current transport regulations internationally?**

ICAO Technical Instructions, IATA Dangerous Goods Regulations and the IMDG Code are the regulations in place to cover international shipments of Lithium and Lithium Ion cells and batteries. All of these codes require cells and batteries of these types to be tested to show compliance with the UN Manual of Tests and Criteria. Additionally, as with the U.S. regulations, the rules apply to cells and batteries shipped alone as well as those shipped with equipment, or contained in equipment as noted by the UN shipping numbers and names for the products as noted in the following table.
These international regulations use only 2 size classifications which are based on lithium content for lithium batteries and Watt-hour rating for Lithium Ion batteries. The table below outlines the shipping regulations currently in effect based on these international regulations.

<table>
<thead>
<tr>
<th>UN Shipping Name</th>
<th>UN Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium ion batteries</td>
<td>UN 3480</td>
</tr>
<tr>
<td>Lithium ion batteries packed with equipment</td>
<td>UN 3481</td>
</tr>
<tr>
<td>Lithium ion batteries contained in equipment</td>
<td>UN 3481</td>
</tr>
<tr>
<td>Lithium metal batteries</td>
<td>UN 3090</td>
</tr>
<tr>
<td>Lithium metal batteries packed with equipment</td>
<td>UN 3091</td>
</tr>
<tr>
<td>Lithium metal batteries contained in equipment</td>
<td>UN 3091</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Cells and Batteries Lithium Content Limits (Cell/Battery)</th>
<th>Secondary Lithium Ion Cells and Batteries Watt-hour Limits (Cell/Battery)</th>
<th>Shipping Classification</th>
<th>Special Packaging/Markings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0g / 2.0g</td>
<td>20Wh / 100Wh</td>
<td>Excepted</td>
<td>Yes</td>
</tr>
<tr>
<td>&gt;1.0g / &gt;2.0g</td>
<td>&gt;20Wh / &gt;100Wh</td>
<td>Class 9</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Notes:
1 – Watt-hours = rated capacity (Ah) X nominal operating voltage (V).

What is meant by “Excepted” in the tables on current U.S. and international regulations?

In both of the above cases, the term “excepted” means that batteries and cells meeting these criteria AND which have passed testing in accordance with the UN Manual of Tests and Criteria, may be shipped without the Class 9 classification. There are still marking, labeling and shipping document requirements that must be met in order to comply with the exceptions.
Can Lithium (metal) primary cells and batteries be shipped as cargo on passenger aircraft?

No, the US DoT prohibits the offering for transportation and transportation of primary lithium (metal) cells and batteries as cargo aboard passenger aircraft, into, out of, and within the United States. The exception to this rule is for primary lithium cells with no more than 1g of lithium content and batteries with no more than 2g of lithium content when they are packed with or installed in equipment only. Even in these cases, the net weight of the cells and batteries in each package cannot exceed 5kg, and the package cannot contain more than the number of cells or batteries necessary to power the piece of equipment.

I make medium cells and/or batteries (according to the US DOT definition) and I need to ship only in the U.S., what are my options?

As we mentioned in the table above for U.S. transport regulations, medium batteries must ship as Class 9 Hazardous Materials. There is a special provision (Special Provision 189) within the U.S. HMR that allows for shipments of “medium size” cells and batteries by motor vehicle or rail car without being classified as Class 9. This provision applies if the following items are met:

1. The cells or batteries are medium based on the U.S. HMR criteria.
2. The cells and batteries have been tested in accordance with the UN Manual of Tests and Criteria.
3. Cells and batteries are prevented from short circuits and are packed in a strong outer packaging or are contained in equipment.
4. The outside of the package is marked “LITHIUM BATTERIES – FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL” on a background of contrasting color, in specific size lettering based on the weight of the package.
5. Each package with more than 12 medium batteries, or 24 medium cells, except when contained in equipment, must comply with appropriate marking, packaging, and documentation requirements.

What does Class 9 mean?
Class 9 is one of nine hazardous material or dangerous goods classes defined by the domestic and international regulations. The class designations define the packaging, marking, labeling, and shipping documentation requirements for items that fall within each class. Class 9 goods are considered miscellaneous hazardous materials. Additional information can be found on the following websites:

U.S. HMR
IATA/ICAO

What regulations apply to Lithium and Lithium Ion cells and batteries that are packed with or contained in equipment?

If a cell or battery must be shipped as a Class 9 Hazardous material, then the same rules apply when they are shipped with or contained in equipment for shipment. The markings, weight limits and documentation requirements change.

Do batteries have to be tested, if they use cells that have already been tested?

Yes. Anyone offering a Lithium or Lithium Ion battery for shipment (alone, installed in or packaged with equipment), is responsible for ensuring that the battery itself meets all the appropriate requirements of the appropriate shipping regulations. This includes testing, marking, labeling, packaging and documentation requirements. In the packaging instructions of the IATA regulations, it states that batteries shall be tested regardless of whether the cells have been tested. For changes to previously tested cells or batteries, the UN Manual of Tests offers some guidance stating that products must be retested if there is a change of more than 0.1g or 20% by mass to the cathode, anode or electrolyte used (20% increase in capacity), or any changes to the construction that could materially affect the outcome of the tests.

Can small consumer primary lithium cells and batteries be shipped by United States Postal Service (USPS)?

Small consumer primary lithium cells and batteries like those used in cameras and flashlights are mailable as long as the following requirements are met:

1. The cells and batteries meet the requirements of small according to the U.S. HMR.
2. Each cell or battery has been tested in accordance with the UN Manual of Tests and Criteria.
3. Packaging must be firmly sealed and provide separation and cushioning to prevent short circuiting, movement or damage during transport.
4. Except for batteries installed in equipment, they must be in a strong outer package. All outer packages must have a complete delivery and return address.

Even with these requirements met, the shipments of Lithium cells and batteries which are not packaged with or installed in equipment are still restricted as follows:

1. Shipment by surface transportation only is allowed when the cells or batteries are in the originally sealed packaging and the package must not exceed 5 pounds.
2. They are also forbidden aboard passenger aircraft. The outside of the package must be marked on the address side “Surface Mail Only, Primary Lithium Batteries – Forbidden for Transportation Aboard Passenger Aircraft.”

If the small primary Lithium cells or batteries are contained in or shipped with equipment, the following restrictions still apply:

1. Shipment by surface or air is allowed when packed with or installed in the equipment they are intended for use with and the mail piece has no more than the number of batteries required to operate the item.
2. When installed, the cells or batteries should be prevented from short circuiting or being damaged during shipment.
3. The device must be provided with an effective means to prevent accidental activation of the cells or batteries.
4. The package must be marked on the address side “Package Contains Primary Lithium Batteries.”
5. The mail piece must not exceed 11 pounds.

Can small consumer Lithium Ion cells and batteries be shipped by United States Postal Service (USPS)?

Small consumer Lithium Ion cells and batteries like the ones used in cell phones and tablets, are mailable with the following restrictions:

1. The cells and batteries meet the limits of small as defined in the U.S. HMR.
2. The cells and batteries have been tested to verify compliance to the UN Manual of Tests and Criteria.
3. Packaging must be firmly sealed and provide separation and cushioning to prevent short circuiting, movement or damage during transport.
4. Except for batteries installed in equipment, they must be in a strong outer package. All outer packages must have a complete delivery and return address.

If the small Lithium Ion cells or batteries are contained in or shipped with equipment, the following restrictions still apply:
1. Shipment by surface or air is allowed when packed with or installed in the equipment they are intended for use with and the mail piece has no more than 3 cells or batteries.
2. When installed, the cells or batteries should be prevented from short circuiting or being damaged during shipment.
3. The device must be provided with an effective means to prevent accidental activation of the cells or batteries.
4. The package must be marked on the address side “Package Contains Lithium Ion Batteries (no lithium metal).”

The following links will provide additional information about mailing of batteries.
Lithium Battery Mailability Chart
USPS Miscellaneous Hazardous Materials Restrictions

What are the UN “T” tests and UN 38.3?

UN 38.3 refers to subsection 38.3 of the UN Manual of Tests and Criteria, Part III. This subsection details the required testing for Lithium and Lithium Ion cells and batteries prior to offering them for shipping. The UN “T” tests refers to the 8 individual tests within this subsection of the UN Manual. The tests are as follows:

T1 – Altitude Simulation
T2 – Thermal Test (Temperature Cycling)
T3 – Vibration
T4 – Shock (Mechanical)
T5 – External Short Circuit  
T6 – Impact (Cell only)  
T7 – Overcharge (Battery only)  
T8 – Forced Discharge (Cell only)

Tests T1 through T5 are done on the same samples in sequence. All other tests are done on separate cells and batteries. The table below details the required number samples for testing:

<table>
<thead>
<tr>
<th>Test (by T number)</th>
<th>Primary Cells</th>
<th>Primary Batteries</th>
<th>Rechargeable Cells</th>
<th>Rechargeable Batteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 – T5</td>
<td>20</td>
<td>8</td>
<td>20</td>
<td>8 (small)/ 4 (large)</td>
</tr>
<tr>
<td>T6</td>
<td>10</td>
<td>-</td>
<td>5 or 10*</td>
<td>-</td>
</tr>
<tr>
<td>T7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8 (small)/ 4 (large)</td>
</tr>
<tr>
<td>T8</td>
<td>10</td>
<td>-</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>8</td>
<td>45 or 50</td>
<td>16 (small)/ 8 (large)</td>
</tr>
</tbody>
</table>

*Prismatic cells require 10 cells for T6

A copy of the UN Manual of Tests and Criteria can be obtained at the following link:

[UNECE download page for UN Manual of Tests and Criteria rev 5](https://www.unece.org/trans/danger/publi/tdg/tdg5en.pdf)

**How do I ship my cells and batteries for testing if they must always be tested prior to shipping?**

All of the regulations discussed here have exceptions or special provisions for the shipment of cells and batteries for testing purposes. Under the U.S. HMR, 49 CFR 173.185(e) allows for the shipment of cells and batteries (not contained in equipment) for testing purposes only by highway and as Class 9 hazardous materials. Additionally, the U.S. HMR and the international Dangerous Goods regulations contain provisions that allow for the shipment by air of prototype cells and batteries. In the U.S. HMR, it is covered under Special Provision A55. In the ICAO Technical Instructions and the IATA Dangerous Goods Regulations, it is under Special Provision A88. However, in order to use these special provisions for air shipments, the shipping party must first obtain an approval from a competent authority in the country of origin. In the U.S. that approval would come from the U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration (PHMSA). Shipments by cargo vessel of
Prototype cells and batteries do not require any prior approvals, however, there are still stringent packaging requirements that can be found in Special Provision 310 in the IMDG Code.

What are the rules for consumers traveling with devices powered by Lithium and Lithium Ion cells and batteries?

Provisions for consumer transport of batteries and battery powered devices are covered in the ICAO Technical Instructions as well as the U.S. HMR. These rules can be found on the U.S. DoT website at http://safetravel.dot.gov/whats_new_batteries.html.

CONTACT ENERGY ASSURANCE or VIST OUR WEBSITE FOR ADDITIONAL INFORMATION

Energy Assurance LLC
5202 Belle Wood Court
Buford, GA 30518
404-954-2054
www.Energy-Assurance.com

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