

Transportation Regulations for Lithium, Lithium-Ion and Lithium-Ion Polymer Cells and Batteries

- Which organizations and regulations govern the transport of lithium, lithium-ion and lithium-ion polymer cells and batteries?

The regulations that govern the transport of primary lithium (metal) and rechargeable lithium-ion (including lithium-ion polymer) cells and batteries include the International Civil Aviation Organization (ICAO) Technical Instructions and corresponding International Air Transport Association (IATA) Dangerous Goods Regulations, and the International Maritime Dangerous Goods (IMDG) Code. In addition, lithium and lithium-ion cells and batteries are regulated in the U.S. in accordance with Part 49 of the Code of Federal Regulations, (49 CFR Sections 100-185) of the U.S. Hazardous Materials Regulations (HMR). Section 173.185 and the Special Provisions contained in Section 172.102 provide information on the exceptions and packaging for shipping based on details of weights, tests and classifications. The hazardous materials table in Section 172.101 also provides related shipping information. The Office of Hazardous Materials Safety, which is within the U.S. Department of Transportation's (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA), is responsible for writing the U.S. regulations that govern the transportation of hazardous materials (also known as dangerous goods) by air, rail, highway and water and drafting the regulations that govern such materials. These regulations are based on the UN Recommendations on the Transport of Dangerous Goods Model Regulations and UN Manual of Tests and Criteria.

- What transportation regulations are currently in effect in the U.S.?

Based on the mass of lithium in the anode of a lithium metal of lithium alloy cell and battery or equivalent lithium content (for lithium-ion cells and batteries), the shipping regulations outlined in the chart below are currently in effect. Pages 2 and 3 contain additional requirements on shipping primary lithium (metal) cells and batteries.

Primary Cell / Battery Max. Lithium Content	Lithium-ion & Polymer Cell / Battery Max. Lithium Content	Shipping Classification/ Testing	Special Packaging/ Markings	Battery Sizes
1.0 gram / 2.0 grams	1.5 grams / 8.0 grams	Excepted / T1-T8 ⁽¹⁾	Yes ⁽²⁾	Small
5.0 grams / 25 grams	5.0 grams / 25 grams	Class 9 / T1-T8 ⁽³⁾⁽⁷⁾	Yes ⁽⁵⁾	Medium
>5.0 grams / >25 grams	>5.0 grams / >25 grams	Class 9 / T1-T8 ⁽⁴⁾⁽⁷⁾	Yes ⁽⁶⁾	Large

- All cells and batteries must pass UN T1-T8 Tests.
- Packages containing more than 12 batteries or 24 cells must meet certain packaging, marking, and shipping paper requirements. See pages 7 and 8.
- Cells and batteries must pass UN T1-T8 Tests and must be shipped as Class 9 hazardous materials unless transported by motor vehicle or rail car.
- Must pass UN T1-T8 Tests and be shipped as a Class 9 hazardous material.
- Requires Class 9 markings, label, specification packaging, and shipping papers unless transported by motor vehicle or rail car. See page 3 and [Exhibit A](#).
- Requires Class 9 markings, label, specification packaging, and shipping papers. See [Exhibit A](#).
- 49 CFR 173.185(a)(1) allows for a cell or battery that was first transported prior to January 1, 2006 and is of a type tested pursuant to the UN Manual of Tests and Criteria, Third Revised Edition, 1999, need not be retested.

▪ **How is equivalent lithium content calculated for lithium-ion cells and batteries?**

Equivalent lithium content for lithium-ion and lithium polymer cells and batteries in grams on a per cell basis is calculated as 0.3 times the rated capacity in ampere-hours. The equivalent lithium content for a battery or battery pack is the rated capacity in ampere-hours for a single cell multiplied by 0.3 and then multiplied by the number of cells in the battery.

▪ **What international transportation regulations currently are in effect?**

The international transportation regulations require battery and cell manufacturers or companies that ship equipment packed with or containing these cells and batteries to meet UN testing, marking, packaging, labeling and shipping paper specifications. These regulations are incorporated into the ICAO Technical Instructions, IATA Dangerous Goods Regulations, and IMDG Code.

See the [Ultralife website](#) for the 2009 IATA Lithium Battery Packing Instructions and the Addendum to the 50th edition of the IATA Dangerous Goods Regulations.

New UN numbers and proper shipping names have been established for Lithium-ion batteries and Lithium-ion batteries packed with or Lithium-ion batteries contained in equipment. In addition, the new proper shipping name for "Lithium batteries" is now "Lithium metal batteries."

Proper Shipping Name	UN Number
Lithium-ion batteries	UN 3480
Lithium-ion batteries packed with equipment	UN 3481
Lithium-ion batteries contained in equipment	UN 3481
Lithium metal batteries	UN 3090
Lithium metal batteries packed with equipment	UN 3091
Lithium metal batteries contained in equipment	UN 3091

Based on lithium content (for primary lithium (metal) cells and batteries) and Watt-hour rating (for lithium-ion cells and batteries), the following international shipping regulations apply:

Primary Cell / Battery Max. Lithium Content	Lithium-ion & Polymer Cell / Battery Max. Watt-Hours	Shipping Classification/Testing	Special Packaging/Markings
1.0 gram / 2.0 grams	20 Wh / 100 Wh	Excepted / T1-T8 ⁽¹⁾	Yes
>1.0 gram / >2.0 grams	>20 Wh / 100 Wh	Class 9 / T1-T8 ⁽²⁾	Yes ⁽³⁾

- (1) Cells and batteries must pass UN T1-T8 Tests. Cells and batteries that pass UN Tests are excepted from regulation. NOTE: The IMDG Code contains a grandfather clause for testing "small" cells and batteries until December 31, 2013.
- (2) Cells and batteries must pass UN T1-T8 Tests and be shipped as Class 9 hazardous materials.
- (3) Requires Class 9 markings, label, specification packaging, and shipping papers. See Exhibit A.

▪ **How is Watt-hours calculated for lithium-ion cells and batteries?**

Multiply a cell or battery's rated capacity, in ampere-hours, by its nominal operating voltage.

The U.S. DOT prohibits the transport of primary lithium (metal) cells and batteries as cargo by passenger aircraft into, out of, or within the United States. What are the implications on shipments of primary lithium (metal) cells and batteries?

The U.S. DOT prohibits the offering for transportation and transportation of primary lithium (metal) cells and batteries as cargo aboard passenger-carrying aircraft into, out of, or within the United States. However, primary lithium (metal) cells with no more than 1g of lithium content and batteries with an aggregate lithium content of no more than 2g **THAT ARE PACKED WITH OR INSTALLED IN EQUIPMENT** are not subject to this prohibition provided the net weight of the batteries in each package does not exceed 5kg (11 lbs.) and the package contains no more than the number of lithium batteries or cells necessary to power the piece of equipment.

The following statement (marking) must be placed on packages containing only primary lithium (metal) cells with no more than 1g of lithium content and batteries with an aggregate lithium content of no more than 2g that are excepted from regulation under the U.S. HMR: "LITHIUM METAL BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT." or "PRIMARY LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT." The marking must be on a background of contrasting color in letters at 12mm (0.5 inch) in height on packages having a gross mass of more than 30kg (66 lbs); **or** at least 6mm (0.25 inch) on packages having a gross mass of 2.5kg (5.5 lbs) or less for shipment by air and a gross mass of 30kg (66.1 lbs) or less for shipment by motor vehicle, rail or vessel. Packages containing primary lithium (metal) cells with more than 1g of lithium content and batteries with an aggregate lithium content of more than 2g and shipped by cargo aircraft must contain the "Cargo Aircraft Only" label.

Required marking for use on packages containing primary lithium (metal) cells with no more than 1g of lithium content and batteries with an aggregate lithium content of no more than 2g that are excepted from regulation under the U.S. HMR:

**LITHIUM METAL BATTERIES -
FORBIDDEN FOR TRANSPORT
ABOARD PASSENGER AIRCRAFT**

- or -

**PRIMARY LITHIUM BATTERIES -
FORBIDDEN FOR TRANSPORT
ABOARD PASSENGER AIRCRAFT**

The U.S DOT's lithium battery final rule that was published on August 9, 2007 also includes a new Special Provision 189 that provides an exception for "medium size" primary lithium (metal) cells and batteries and rechargeable lithium-ion cells and batteries transported by motor vehicle or rail car. Special

Provision 189 provides "medium" cells and batteries transported by motor vehicle or rail car an exception from the requirements of the U.S. HMR if they meet all of the following:

- (a) For primary lithium cells, the lithium content in each cell, is not more than 5 grams and the aggregate lithium content in each battery is not more than 25 grams;
- (b) For lithium-ion cells, the equivalent lithium content in each cell is not more than 5 grams and the aggregate equivalent lithium content in each battery, is not more than 25 grams;
- (c) The cells and batteries have been tested in accordance with the tests in the UN Manual of Tests and Criteria;
- (d) Cells or batteries are separated so as to prevent short circuits and are packed in a strong outer packaging or are contained in equipment;
- (e) The outside of each package must be marked "LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL" on a background of contrasting color, in letters:
 - (1) At least 12mm (0.5 inch) in height on packages having a gross mass of more than 30kg (66 lbs); or
 - (2) At least 6mm (0.25 inch) on packages having a gross mass of 30kg (66.1 lbs) or less, except that smaller font may be used as necessary to fit package dimensions; and
- (f) Each package with more than 12 medium batteries or 24 medium cells, except when contained in equipment, must comply with the marking, packaging, and documentation requirements listed on page 8.

Required marking for use on packages containing primary lithium (metal) cells with no more than 5 grams of lithium content and primary lithium (metal) batteries with an aggregate lithium content of no more than 25 grams or lithium-ion cells with an equivalent lithium content of no more than 5 grams and lithium-ion batteries with an aggregate equivalent lithium content of no more than 25 grams when transported by motor vehicle or rail car:

LITHIUM BATTERIES - FORBIDDEN FOR TRANSPORT ABOARD AIRCRAFT AND VESSEL

▪ **What U.S. Postal Service transportation regulations are in effect?**

The U.S. Postal Service (USPS) standards identify all small consumer-type lithium batteries as mailable when properly packaged and labeled.

Small consumer-type primary lithium (metal) cells or batteries (lithium metal or lithium alloy) like those used to power cameras and flashlights are mailable with the following restrictions. Each cell must contain no more than 1.0 gram (g) of lithium content per cell. Each battery must contain no more than 2.0g aggregate lithium content per battery. Additionally, each cell or battery must meet the requirements of each test in the *UN Manual of Tests and Criteria*, Part III, and subsection 38.3 as referenced in DOT'S hazardous materials regulation at 49 CFR 171.7. All primary lithium (metal) cells and batteries must be mailed within a firmly sealed package separated and cushioned to prevent short circuit, movement, or damage. 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.

Primary lithium (metal) cells and batteries are available as follows:

- (a) Via surface transportation when the cells or batteries (not packed with or installed in equipment) are "in the originally sealed packaging." They are 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." The mail piece must not exceed 5 pounds.

Marking for use on packages containing primary lithium (metal) cells and batteries:

**SURFACE MAIL ONLY,
PRIMARY LITHIUM BATTERIES -
FORBIDDEN FOR TRANSPORT
ABOARD PASSENGER AIRCRAFT**

- (b) Via surface or air transportation when the cells or batteries are properly packed with or properly installed in the equipment they operated and the mail piece has no more than the number of batteries needed to operate the device. Cells or batteries properly installed in the device they operate must be protected from damage and short circuit, and the device must be equipped with an effective means of preventing accidental activation. The outside of the package must be marked on the address side "Package Contains Primary Lithium Batteries." The mail piece must not exceed 11 pounds.

Marking for use on packages containing primary lithium (metal) cells and batteries packed with or installed in equipment:

**PACKAGE CONTAINS
PRIMARY LITHIUM BATTERIES**

Small consumer-type rechargeable lithium-ion cells and batteries like those used to power cell phones and laptop computers are available with the following restrictions. Each cell must contain no more than 1.5g of equivalent lithium content per cell. Each battery must contain no more than 8.0g aggregate quantity of equivalent lithium content per battery. Additionally, each cell or battery must meet the requirements of each test in the *UN Manual of Tests and Criteria*, Part III, and subsection 38.3 as referenced in the DOT's hazardous materials regulation at 49 CFR 171.7. All secondary lithium-ion cells and batteries must be mailed in a firmly sealed package separated and cushioned to prevent short circuit, movement, or damage. 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.

Lithium-ion cells and batteries are available as follows:

- (a) Via surface or air transportation when individual cells or batteries are mailed or when properly packed with or properly installed in the equipment they operate. Cells or batteries properly installed in the device they operate must be protected from damage and short circuit, and the device must be equipped with an effective means of preventing accidental activation. The outside of the package must be marked on the address side, "Package Contains Lithium-ion Batteries (no lithium metal)."

(b) The mail piece must not contain more than 3 batteries.

Marking for use on packages containing lithium-ion cells and batteries, including cells or batteries packed with or installed in equipment:

PACKAGE CONTAINS LITHIUM-ION BATTERIES (NO LITHIUM METAL)

Damaged or Recalled Batteries

Damaged or recalled batteries are prohibited from mailing unless approved by the manager, USPS Mailing Standards.

Battery-Powered Devices

Cells or batteries properly installed in equipment must be protected from damage and short circuit and equipment or devices containing cells or batteries must include an effective means of preventing accidental activation.

USPS LITHIUM BATTERY MAILABILITY CHART

Primary lithium batteries (small non-rechargeable consumer-type batteries)	Surface transportation	Air transportation	Mail piece weight limit	International APO/FPO
Without the equipment they operate (individual batteries).	Mailable	Prohibited	5 lb	Prohibited.
Packed with equipment but not installed in equipment.	Mailable	Mailable	11 lb	Mailable.
Contained (properly installed) in equipment.	Mailable	Mailable	11 lb	Mailable.

Note 1: Each primary cell must not contain more than 1g lithium content

Note 2: Each primary battery must not contain more than 2g lithium content

Secondary lithium-ion batteries (small rechargeable consumer-type batteries)	Surface transportation	Air transportation	Mailpiece battery limit	International APO/FPO
Without the equipment they operate (individual batteries).	Mailable	Mailable	no more than 3 batteries..	Mailable.
Packed with equipment but not installed in equipment.	Mailable	Mailable	no more than 3 batteries..	Mailable.
Contained (properly installed) in equipment.	Mailable	Mailable	no more than 3 batteries..	Mailable.

Note 3: Each secondary cell must not contain more than 1.5g equivalent lithium content

Note 4: Each secondary battery must not contain more than 8g equivalent lithium content

Note 5: For secondary batteries (lithium-ion) there is a limit of 3 batteries per mail piece

▪ **What are the UN "T" tests required by the UN regulator scheme?**

The UN Manual of Tests and Criteria, Fourth Revised Edition (2003), contain the UN T1-T8 Tests that are listed below. These tests only have to be performed once for each cell and battery of a given design, and must be completed prior to shipment. Lithium cells or batteries, which differ from a tested type by:

- (a) A change of more than 0.1g or 20% by mass, whichever is greater, to the cathode, to the anode, or to the electrolyte; or
- (b) A change that would materially affect the test results,

shall be considered a new design type and shall be subjected to the required tests. Cells and batteries of identical design only have to be tested on time.

The following tests must be performed on all primary lithium (metal), rechargeable lithium-ion and lithium-ion polymer cells or batteries. See table below to determine quantities required for testing.

Test T1: Altitude Simulation - Simulates air transport under low-pressure conditions. Store at 11.6kPa or less for 6 hours at 20°C

Test T2: Thermal Test - Assesses cell and battery seal integrity and internal electrical connections using thermal cycling to simulate rapid and extreme temperature changes. Perform 10 cycles between 75°C and -40°C, 6 hours per cycle with no more than 30 minutes between cycles, and then observe for 24 hours.

Test T3: Vibration - Simulates vibration during transport. Sinusoidal waveform with a logarithmic sweep between 7Hz and 200Hz and back to 7Hz in 15 minutes. This cycle must be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the cell or battery.

Test T4: Shock - Simulates possible impacts during transport. Half-sine shock of peak acceleration of the positive direction and 3 shocks in the negative direction of three mutually perpendicular mounting positions for a total of 18 shocks.

Test T5: External Short Circuit - Simulated an external short circuit. After stabilizing at 5°C, apply an external resistance of less than 0.1 ohm for 1 hour and then observe for 6 hours.

Test T6: Impact - Simulates an impact. Place a 15.8mm diameter bar across the sample and then drop a 9.1kg mass from a height of 61cm on to the bar, and then observe for 6 hours.

Test T7: Overcharge - Evaluates the ability of a rechargeable battery to withstand overcharge. Charge at twice the manufacturer's recommended maximum continuous charge current for 24 hours, and then observe for 7 days.

Test T8: Forced Discharge - Evaluates the ability of a primary or a rechargeable cell to withstand forced discharge. Force discharge at an initial current equal to the maximum discharge current specified by the manufacturer, and then observe for 7 days.

- **How many primary and rechargeable cells or batteries are required for testing, and which tests are performed for each?**

Tests are performed sequentially on the same group of cells or batteries as shown below:

T-Tests	Primary Cells	Primary Batteries		Rechargeable Cells	Rechargeable Batteries
T1 - T5	20	8		20	16
T6	10	---		10 or 20 ⁽¹⁾	---
T7	---	---		---	8
T8	10	---		20	---
Total	40	8		50 or 60	24

(1) 20 = prismatic cells

Where can I obtain a copy of the complete UN testing requirements?

You can obtain a copy of the test requirements portion of the UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, from the Ultralife website, www.ultralifecorporation.com.

- **If my cells or batteries must be tested prior to shipping, how am I supposed to ship these products to a testing facility without violating the hazardous materials regulations?**

Under 49 CFR 173.185(e) of the U.S. HMR, when not contained in equipment, cells and batteries shipped for testing purposes may be shipped only by highway and as Class 9 hazardous materials.

In addition, the U.S. HMR and international dangerous goods regulations contain provisions that authorize shipments by air of "prototype" cells and batteries. These provisions are found in a Special Provision A55 in the U.S. HMR and Special Provision A88 in the ICAO Technical Instructions and IATA Dangerous Goods Regulations. However, shippers that want to offer prototype cells and batteries by air transport must first secure a "competent authority approval" from the appropriate transportation agency in the country of origin. In the U.S., shippers must apply for this approval with the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA).

Shippers of prototype cells and batteries also have the option of shipping their products internationally by cargo vessel. No approval is required for such shipments but there are very stringent packaging requirements. The provision that applies to such shipments is Special Provision 310 in the IMDG Code.

- **Has the UN testing deadline been extended for small cells and batteries?**

The IMDG Code authorizes primary lithium (metal) cells with no more than 1 gram of lithium metal and batteries with no more than 2 grams of lithium metal, and lithium-ion cells with no more than 1.5 grams and batteries with no more than 8 grams of equivalent lithium content that were designed and manufactured prior to January 1, 2003 an exception from the UN T1-T8 testing requirements until December 31, 2013 ONLY if shipped by sea pursuant to the IMDG Code.

▪ **What does Class 9 mean?**

Class 9 is one of nine classes of hazardous materials (dangerous goods) defined by the U.S. HMR. and other transportation regulations. Class 9 defines the specification packaging, markings, labeling, and shipping paper requirements for "Miscellaneous" hazardous materials, which include primary lithium (metal) cells and batteries and lithium-ion cells and batteries, among other materials. See **Exhibit A** for packaging, marking, labeling, and shipping paper requirements. Additional information on shipping hazardous materials can be found on the U.S. Department of Transportation's PHMSA website at: <http://www.phmsa.dot.gov/hazmat> or IATA's website at http://www.iata.org/whatwedo/cargo/dangerous_goods/Pages/index.aspx.

▪ **Are there any marking, packaging, and shipping paper requirements for excepted cells and batteries?**

Yes. **Under the U.S. regulations** except for batteries contained in equipment, packages containing more than 24 lithium or lithium-ion cells or 12 lithium or lithium-ion batteries must:

- Be marked to indicate that they contain lithium, lithium-ion or lithium polymer cells or batteries that special procedures should be followed in the event that the package is damaged (**see recommended marking (label) on following page**);
- Be accompanied with a document indicating that packages contain lithium batteries and that special procedures should be followed in the event a package is damaged;
- Be capable of withstanding a 1.2 meter (3.9ft) drop test in any orientation without damage to cells or batteries contained in the package, without shifting of the contents that would allow short circuiting and without release of package contents; and
- Not exceed 30kg (66.1 lbs) gross mass. (Does not apply to batteries packed with equipment.)

When shipping internationally under the ICAO Technical Instructions, IATA Dangerous Goods Regulations or IMDG Code -

Each package must be capable of withstanding a 1.2m drop test in any orientation

- Without damage to cells or batteries contained therein;
- Shifting of the contents so as to allow battery to battery (or cell to cell) contact;
- Release of contents.

Each consignment must be accompanied with a document such as an air waybill with an indication that:

- The package contains lithium-ion cells or batteries;
- The package must be handled with care, and that a flammability hazard exists if the package is damaged;
- Special procedures should be followed in the even the package is damaged, to include inspection and repacking if necessary; and
- A telephone number for additional information.

Each consignment must comply with the following weight or numerical restrictions:

- Lithium metal batteries: Shall not exceed 2.5kg (5.5 lbs) gross mass for shipment by air and a gross mass of 30kg (66.1 lbs) or less for shipment by motor vehicle, rail or vessel. (Does not apply to batteries packed with or contained in equipment.)
- Lithium-ion batteries: Shall not exceed 10kg (22 lbs) gross mass for shipment by air and a gross mass of 30kg (66.1 lbs) or less for shipment by motor vehicle, rail or vessel. (Does not apply to batteries packed with or contained in equipment.)
- For batteries packed with equipment, the maximum number of batteries in each package must be the minimum number required to power the equipment plus two spares.

Labels (markings) for use with excepted lithium metal and excepted lithium-ion and lithium-ion polymer cells or batteries:

- Minimum dimensions required for international air shipments: 120 x 110mm (4.75 x 4.33 in).^{*} *Smaller dimensions can be used for shipments by motor vehicle, cargo vessel and rail*
- Color required for international air shipments: **Black with red hatching on a contrasting background.** *Black hatching can be used for shipments by motor vehicle, cargo vessel and rail*



Label for use with
excepted lithium metal
cells or batteries



Label for use with excepted
lithium ion and lithium ion
polymer cells or batteries

* Labels not shown with actual dimensions

Important note regarding use of CHEMTREC telephone numbers: Companies that list CHEMTREC'S emergency number on their packaging must be registered with CHEMTREC, and pay an annual fee. This includes the "shipper of record," who must also be registered in order to comply with Federal DOT regulations. This regulation (49CFR §172.604) states that the shipper of record must have a 24-hour emergency telephone number. Although the shipper may not be the manufacturer of the product, being able to reach the shipper to provide disposition instructions or other assistance is often required. Any technical information about the product can be obtained from the MSDS provided by the shipper, from CHEMTREC's database of technical information, or through CHEMTREC's contacts with the manufacturer.

▪ **How do the regulations apply to Class 9 lithium or lithium-ion cells and batteries packed with or contained in equipment?**

If cells or batteries must be shipped as Class 9 hazardous materials, equipment that is packed with or containing these same-type cells and batteries also must be shipped as Class 9 hazardous materials. There are different Class 9 markings and weight limitations that apply to packages containing batteries packed with or contained in equipment. For example, if shipping by air a fully-regulated Class 9 lithium

battery contained in equipment, the package must be marked, "Lithium batteries contained in equipment UN3091," and the net weight of the battery in the equipment cannot exceed 5kg (11 lbs).

- **What regulations apply to the shipment of discharged lithium cells and batteries?**

Except when shipped for disposal or recycling, the U.S. HMR prohibits the shipping of any cells and batteries with a liquid cathode containing sulfur dioxide, sulfuryl chloride or Thionyl chloride if any cell has been discharged to the extent that the open circuit voltage is less than two volts, or is less than two-thirds of the voltage of the fully charged cell, whichever is less. These regulations only apply to the three liquid cathode chemistries noted. Discharged solid cathode cells and batteries, i.e., lithium manganese dioxide, are not subject to this prohibition and may be shipped by any mode of transportation regardless of voltage. Note, however, that shipments of discharged lithium cells and batteries of any chemistry must be in accordance with the appropriate shipping classification requirements. i.e., Excepted or Class 9, including packaging and labeling, as dictated by the lithium content of the cell and battery. It is Ultralife's policy to ship discharged or depleted lithium cells and batteries by ground or ocean only.

- **Are there any training requirements for employees of companies that ship lithium cells and batteries?**

Yes. The international and U.S. transportation regulations require employees involved in the packaging or shipment of Class 9 lithium or lithium-ion cells and batteries complete a hazardous materials training course. Employees must renew their certification training every three years in the U.S. and every two years under the international regulations. It is strongly recommended that employees also complete an "IATA training" course. The new IATA and ICAO regulations also require that "Any person preparing or offering [excepted] cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities."

- **Can exemptions to the shipping regulations be requested?**

Yes. Exemptions to the regulations for shipments of a specific cell or battery type may be requested from the countries of origin and destination, and cleared with the carrier. An "Approval" from the U.S. DOT serves a similar purpose and there are several provisions in the U.S. and international regulations that specify when a shipper of lithium batteries should secure an Approval from an "appropriate authority." Sufficient product information should be provided in the request and include cell and battery lithium content, safety test data (if available), and the application in which the cells or batteries will be used. If granted, an Approval can take from 12 to 16 weeks to secure from the DOT. Approvals may be transferable, so if a cell or battery manufacturer obtains an Approval, it may be transferred to their customer(s) who would receive and subsequently re-ship the product.

- **Do batteries that are manufactured by battery assembly companies have to be tested, even if they use cells that have already been tested by the cell manufacturers?**

All OEM customers, distributors, battery assemblers, etc. are responsible for adhering to the packaging and marking requirements when re-shipping cells or batteries, and must ensure that the proper packaging and labeling is used when using packaging or labels other than the original materials in which the product was received. All OEM customers, distributors and battery assemblers are responsible for obtaining new UN testing if they combine, reconfigure or assemble cells or batteries such that they differ from the original tested version (e.g., building cells into battery pack). As previously described, new tests must be performed on a cell or battery if the cell or battery differs from the original tested type by:

- (a) A change of more than 0.1g or 20% by mass, whichever is greater, to the cathode, to the anode, or to the electrolyte; or
- (b) A change that would materially affect the test results.

▪ **Are there any fines if shipping regulations are violated?**

Yes! Each violation of the U.S. DOT HMR is subject to a fine of up to \$50,000 (or up to \$100,000 if DOT finds the violation results in "*death, serious illness, or severe injury to any person or substantial destruction of property.*") Fines are additive and multiple fines may be imposed for a single shipment of cells or batteries that may have a combination of testing, packaging, labeling or other violations.

▪ **Are there any provisions in the regulations that enable passengers to carry electronic devices containing lithium or lithium-ion batteries or spare batteries onto airplanes in carry-on baggage?**

Yes. There are provisions in the ICAO Technical Instructions and U.S. DOT HMR that enable passengers to carry on most consumer batteries and personal battery-powered consumer electronic and medical devices, including spare batteries, when carried for personal use.

Each spare battery must be individually protected as to prevent damage and short circuits by placement in original retail packaging or by otherwise insulating the terminals, e.g., by taping over exposed terminals or placing each battery in a separate plastic bag (such as a Ziploc[®] bag) or protective pouch, and carried in carry-on baggage only.

All spare batteries must be individually protected so as to prevent damage and short circuits and placed in carry-on baggage only.

Battery-powered devices should be protected from accidental activation.

Batteries allowed in carry-on baggage include:

Lithium-ion (including lithium polymer) rechargeable batteries: Passengers may carry consumer-sized lithium-ion batteries (containing no more than 8 grams of equivalent lithium (approximately 100 Watt-hours) per battery. This includes: AA, AAA, 9-volt, mobile/cell phone, PDA, camera, camcorder, MP3 player, hand held game and standard laptop computer batteries.

- In the U.S., passengers can also bring two (2) larger lithium-ion batteries (more than 8 grams and up to 25 grams of equivalent lithium content per battery) in their carry-on baggage. 25 grams of equivalent lithium content is equal to approximately 300 Watt-hours. This size includes larger extended-life laptop batteries.
- When traveling internationally, passengers can bring two (2) larger lithium-ion batteries containing up to 160 Watt-hours in their carry-on baggage but must secure the airline's Approval to carry these on the aircraft.

Passengers are prohibited from carrying on lithium-ion batteries containing more than 25 grams of equivalent lithium content (approximately 300 Watt-hours).

Primary lithium (metal) / non-rechargeable batteries: These batteries are used in cameras and other personal electronic devices such as small flashlights and personal air ionizers. Consumer-sized batteries (up to 2 grams of lithium per battery) may be carried. This includes: AA, AAA, CR123A, CR1, CR2, CRV3, CR22, 2CR5, etc., as well as lithium watch batteries (also called coin or button cells).

Passengers are prohibited from carrying on lithium batteries containing more than 2 grams of lithium content.

- **Are there any provisions in the regulations that allow lithium or lithium-ion batteries in checked baggage?**

Spare lithium or lithium-ion batteries are NOT allowed in checked baggage. Battery-powered devices with batteries installed in the device are allowed in checked baggage. Devices containing batteries, particularly those with moving parts or those that can heat up, such as cordless power tools, should be protected from accidental activation by moving the on/off switch to the "off" position or by placing the device in a protective case.

Spare lithium metal and lithium-ion batteries of any size are prohibited in checked baggage.

- **Is there a limit to the number of batteries that can be carried in carry-on baggage?**

There is no limit to the number of consumer-size batteries or battery-powered devices that a passenger can carry. **Only the larger lithium-ion batteries are limited to two (2) batteries per passenger.**

- **Where can I find information on the transportation of regulations that apply to Ultralife's lithium, lithium-ion and polymer cells and batteries?**

You can obtain a list of the Ultralife Batteries brands cells and batteries, which includes lithium weights and transportation classifications, from Ultralife's website, www.ultralifecorporation.com.

- **Who can I contact if I have more questions about battery transportation?**

Please contact Ultralife for answers to questions regarding the transportation of Ultralife lithium, lithium-ion or lithium polymer cells and batteries at: 800-332-5000 (U.S. & Canada), 315-332-7100, or 44-1235-542600 (Europe); or visit Ultralife's website at: www.ultralifecorporation.com.

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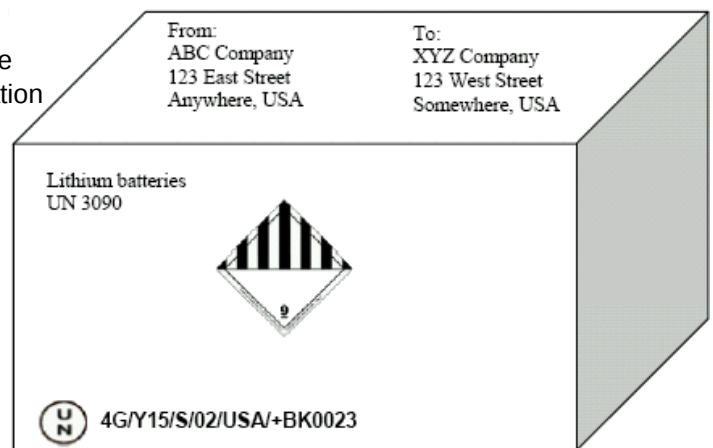
Exhibit A - Packaging, Marking, Labeling, and Shipping Paper Requirements for Class 9 Lithium and Lithium-ion Cells and Batteries

1. **PACKAGING** - Use only packaging that meets "Packing Group II" performance standards. Refer to the appropriate hazardous materials transportation regulations for the list of approved Packing Group II packaging and Performance - Oriented Packaging Standards.
 - ⇒ Packages must not exceed 5kg (11 lbs) (gross mass) for passenger aircraft
 - ⇒ Packages must not exceed 35kg (77 lbs) (gross mass) for cargo aircraft
2. **MARKING** - The following markings must be applied to the packaging:
 - ⇒ Shipping name: *Lithium metal batteries* or *Lithium-ion batteries*
 - ⇒ Identification number: *UN 3090* or *UN 3480*
 - ⇒ Shippers name and address
 - ⇒ Name and address of company or individual receiving batteries (also known as the "consignee")
 - ⇒ UN packaging specifications
3. **LABELING*** - The following Class 9 label must be used: 
4. **SHIPPING PAPERS** - The following information must be included on shipping papers:
 - ⇒ Proper shipping name, hazard class, identification number, and packing group in the following order (Example: UN3090, *Lithium batteries*, 9, , II)
 - ⇒ Number of and type of packages (Example: 12 fiberboard boxes)
 - ⇒ Weight
 - ⇒ Page number and total number of pages (Example: *Page 1 of 2 Pages*)
 - ⇒ Emergency telephone number (Ultralife uses Chemtrec in the U.S.: 1-800-424-9300)
 - ⇒ Shipper's certification (Example: *This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation (by air, if applicable) according to the applicable international and national governmental regulations.*)
 - ⇒ Signature of shipper

NOTE: If SHIPPING BY AIR, the following additional information is required for hazardous materials:

- ⇒ Air Waybill Number
- ⇒ Proper certification (I declare that all of the applicable air transport requirements have been met.)
- ⇒ Indication of whether "Passenger and Cargo Aircraft" or "Cargo Aircraft Only"
- ⇒ Airport of Departure
- ⇒ Airport of Destination
- ⇒ Shipment Type: Non-radioactive or radioactive
- ⇒ Place and date of signing of shippers certification

** An additional marking and/or "Cargo Aircraft Only" label (see below) are required if shipping primary lithium cells or batteries into, out of, or within the U.S. See pages 2 and 3 for more*



Example Only - Markings and labels may vary depending on type and size of batteries shipped.