

Understanding Lithium Shipping Regulations



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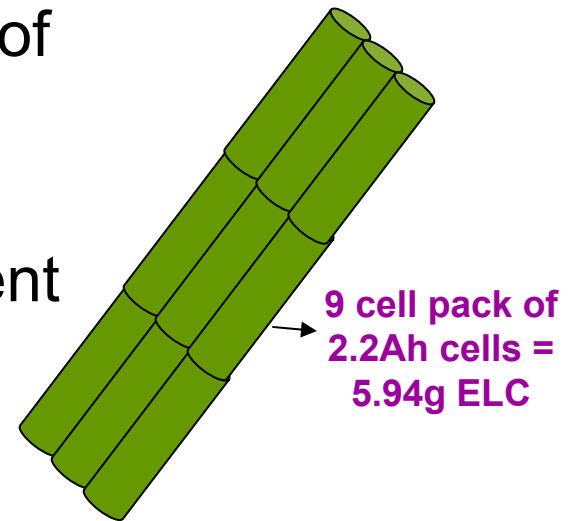
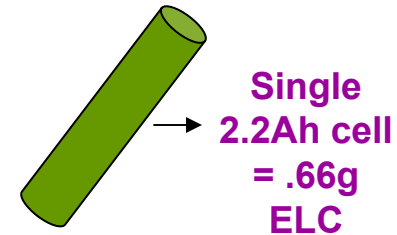
Shipping Lithium & Li-Ion batteries

- **Two regulating authorities: U.S. Hazardous Materials Regulations (HMR) and its associated Code of Federal Regulations (CFR), and International Air Transport Association (IATA)**
- **All lithium/lithium ion cells and batteries are regulated as Class 9 “hazardous materials” or “dangerous goods” for shipping domestically & internationally**
- **There are exceptions to the HMR & IATA regulations for “small” lithium/li-ion batteries based on amount of lithium in these batteries**
- **Amount of lithium in li-ion batteries is determined by “equivalent lithium content”**
- **Equivalent lithium content: Calculated in grams on per-cell basis as 0.3 times the rated capacity of the cell in Ampere-hours times the number of cells per pack**

Calculating Equivalent Lithium Content (for Li-Ion)

Example:

- A lithium ion **cell** with rated capacity of 2.2Ah
- Applying conversion factor of 0.3, the cell has 0.66 grams ($2.2 \times 0.3 = .66$) of equivalent lithium content
- A battery **pack** containing 9 of these cells contains 5.94 grams of equivalent lithium content ($9 \text{ cells} \times .66 = 5.94\text{g ELC}$)



$2.2 \times 0.3 \times 9 = 5.94 \text{ grams}$
of equivalent lithium content in 9-cell 2.2Ah pack

Lithium/Li-Ion Battery Transportation Regulations **Currently in Effect** for Domestic Shipping

In HMR: 49 CFR Section 173.185

Primary Cell / Battery Maximum Lithium Content	Lithium Ion & Polymer Cell / Battery Maximum Lithium Content	Shipping Classification / Testing	Special Packaging / Markings
1.0 g / 2.0 g	1.5 g / 8.0 g (max = 12 cell 2.2Ah pack or 9 cell 2.4Ah pack)	Excepted	No
5.0 g / 25 g	5.0 g / 25 g	Excepted / T1-6	No
>5.0 g / >25 g	>5.0 g / >25 g	Class 9 / T1-T6	Yes

Lithium/Li-Ion Battery Transportation Regulations **Currently in Effect** for **International Shipping**

IATA DGR: A45/PI 903 (2004)

Primary Cell / Battery Maximum Lithium Content	Lithium Ion & Polymer Cell / Battery Maximum Lithium Content	Shipping Classification / Testing	Special Packaging / Markings
1.0 g / 2.0 g	1.5 g / 8.0 g (max = 12 cell 2.2Ah or 9 cell 2.4Ah pack)	Excepted / T1- T8	Yes
>1.0 g / >2.0 g	>1.5 g / >8.0 g	Class 9 / T1-T8	Yes

Grandfather Clause in IATA: Lithium / Lithium ion cell and battery designs previously exempted from testing & manufactured before January 1, 2003 do not require testing until January 1, 2005



Proposed DOT change for Domestic Shipping of New* Products: Adoption of IATA (SP A45) regulations, estimated by Summer 2005

Still under negotiation:

- Economic impact on small business with regard to testing costs was not considered in proposal
- May be able to piggy back testing of similar designs and/or similar cells
- Maximum equivalent lithium content

Either way: International regulations are in effect; more stringent testing will be necessary!

*Proposal says designs previously excepted & mfg'd prior to 1/1/03 have until 1/1/05



UN Manual of Tests & Criteria “T” Tests Required:

- T1 Altitude Simulation
 - T2 Thermal Test
 - T3 Vibration
 - T4 Shock
 - T5 External Short Circuit
 - T6 Impact
 - T7 Overcharge
 - T8 Forced Discharge
- } Currently IATA only, but part of proposed rule

In addition to the testing cost (\$4k-\$5k), each test requires several cells/packs to produce the test

Cells and Batteries Required for UN “T” Tests

T1 – T5

- 20 primary cells and 8 primary batteries
- 20 rechargeable cells and 16 rechargeable batteries

T6

- 10 or 20 (prismatic) primary cells and 10 or 20 (prismatic) rechargeable cells

T7

- 8 rechargeable batteries

T8

- 10 primary cells and 20 rechargeable cells

	Cylindrical Cells	Prismatic Cells	Battery Packs
Primary	40	50	8
Secondary	50	60	24

The “20%” Rule

Section 38.3.2 of the UN Manual of Tests and Criteria

- Used to determine “new” type of cell or battery that requires testing
- A change of more than 0.1 g or 20% by mass, whichever is greater, to the cathode, to the anode, or to the electrolyte; or
- A change that would materially affect the test results

Other Exceptions, Special Provisions, and Approvals For Prototypes

Special Provision DOT, IATA, ICAO

- Prototype lithium batteries and cells that are packed with not more than 24 cells or 12 batteries per packaging that have not been tested to the requirements may be transported if approved by the Associate Administrator
- Can be transported by ground or by cargo aircraft only (DOT)
- Must be packaged to meet the requirements of Packaging Group 1
- Each cell and battery must be individually packed in an inner packaging inside and outer packaging and surrounded by cushioning material that is non-combustible and non-conductive. Cells and batteries must be protected against short circuit

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