

Understanding Lithium Shipping Regulations

Updated to reflect US Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) Lithium Battery Final Rule of August 2007



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Updates to previous ruling

- Classification of “small”, “medium” and “large” batteries
- A 100-Unit small production run exemption for “small lithium cells and batteries
- Expand exception for shipping lithium batteries for disposal to include shipping batteries for recycling
- Confirmation that single cell lithium batteries do not require UN testing provide the cell was previously tested pursuant to the UN Manual for Tests and Criteria

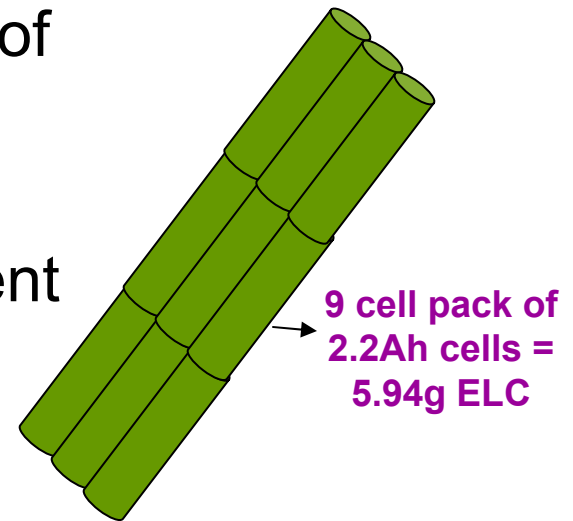
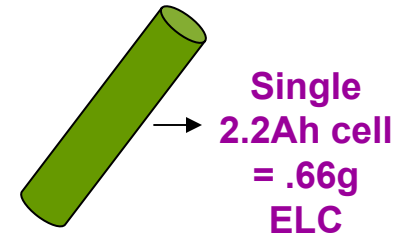
Shipping Lithium & Li-Ion batteries

- **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

Battery and Cell Category Definitions

In HMR: 49 CFR Section 173.185

		Small (no more than)	Medium (between)	Large (more than)
Cells	Primary	1 g Li	1 g and 5 g Li	5 g Li
	Secondary	1.5 g ELC	1.5 g and 5 g ELC	5 g ELC
Batteries	Primary	2 g Li	2 g and 25 g Li	25 g Li
	Secondary	8 g ELC	8 g and 25 g ELC	25 g ELC

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 Small	1.5 g / 8.0 g (max = 12 cell 2.2Ah pack or 9 cell 2.4Ah pack)	Excepted	Yes
5.0 g / 25 g Medium	5.0 g / 25 g	Excepted / T1-6	Yes
>5.0 g / >25 g Large	>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 Small	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 Medium & Large	>1.5 g / >8.0 g	Class 9 / T1-T8	Yes

Lithium/Li-Ion Battery Transportation Regulations for Domestic Shipments **Effective October 1, 2009**

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

HARMONIZATION IS HAPPENING



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 (\$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 188

- Requires each package with more than 12 small batteries or 24 small cells, except when contained in equipment, to be:
 - Marked to indicate it contains lithium batteries, and special procedures should be followed in the event that the package is damaged
 - Accompanied by a document indicating that the package contains lithium batteries and special procedures should be followed in the event that the package is damaged
 - Capable of withstanding a 1.2 meter 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
 - Not exceeding a gross weight of 30kg (66 lbs). This requirement does not apply to lithium cells or batteries packed with equipment
 - Effective date is October 1, 2008

Other Exceptions, Special Provisions, and Approvals For Prototypes

Special Provision 188, continued:

- For Lithium Primary Batteries:
 - Each Package containing lithium primary batteries is to be marked “PRIMARY LITHIUM BATTERIES – FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT” or “LITHIUM METAL BATTERIES – FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT”.
 - Marking is not required on packaged that contain 5kg (11 lbs) net weight or less of primary lithium batteries or cells that are contained with or packed with equipment.

Other Exceptions, Special Provisions, and Approvals For Prototypes

Special Provision 29

- Exception from UN Testing requirements for “low production” small cells and batteries
 - Production runs of no more than 100 small lithium cells and batteries transported by motor vehicle, rail car, or vessel
 - Must be shipped as Class 9 Hazardous and transported in Packing Group I outer packaging that is a metal, plastic or plywood drum or metal, plastic or wooden box
 - Each cell or battery must be individually packed in an inner packaging inside an outer packaging and surrounded by a cushioning material that is non-combustible, and non-conductive.
 - Effective date is October 1, 2009

Contact Rose for further information



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