

## U.S. Hazardous Materials Regulations (January 2008)

### 49 CFR § 173.185 Lithium batteries and cells

(a) Cells and batteries. A lithium cell or battery, including a lithium polymer cell or battery and a lithium-ion cell or battery, must conform to all of the following requirements:

- (1) Be of a type proven to meet the requirements of each test in the UN Manual of Tests and Criteria (IBR; see Sec. 171.7 of this subchapter). A cell or battery and equipment containing a cell or battery that was first transported prior to January 1, 2006 and is of a type proven to meet the criteria of Class 9 by testing in accordance with the tests in the UN Manual of Tests and Criteria, Third Revised Edition, 1999, need not be retested.
- (2) Incorporate a safety venting device or otherwise be designed in a manner that will preclude a violent rupture under conditions normally incident to transportation.
- (3) Be equipped with an effective means to prevent dangerous reverse current flow (e.g., diodes, fuses, etc.) if a battery contains cells or series of cells that are connected in parallel.
- (4) Be packaged in combination packagings conforming to the requirements of part 178, subparts L and M, of this subchapter at the Packing Group II performance level. The lithium battery or cell must be packed in inner packagings in such a manner as to prevent short circuits, including movement which could lead to short circuits. The inner packaging must be packed within one of the following outer packagings: metal boxes (4A or 4B); wooden boxes (4C1, 4C2, 4D, or 4F); fiberboard boxes (4G); solid plastic boxes (4H2); fiber drums (1G); metal drums (1A2 or 1B2); plywood drums (1D); plastic jerricans (3H2); or metal jerricans (3A2 or 3B2).
- (5) Be equipped with an effective means of preventing external short circuits.
- (6) Except as provided in paragraph (d) of this section, cells and batteries with a liquid cathode containing sulfur dioxide, sulfuryl chloride or thionyl chloride may not be offered for transportation or transported if any cell has been discharged to the extent that the open circuit voltage is less than two volts or is less than 2/3 of the voltage of the fully charged cell, whichever is less.

(b) Lithium cells or batteries packed with equipment. Lithium cells or batteries packed with equipment may be transported as Class 9 materials if the batteries and cells meet all the requirements of paragraph (a) of this section. The equipment and the packages of cells or batteries must be further packed in a strong outer packaging. The cells or batteries must be packed in such a manner as to prevent short circuits, including movement that could lead to short circuits.

(c) Lithium cells or batteries contained in equipment. Lithium cells or batteries contained in equipment may be transported as Class 9 materials if the cells and batteries meet all the requirements of paragraph (a) of this section, except paragraph (a)(4) of this section, and the equipment is packed in a strong outer packaging that is waterproof or is made waterproof through the use of a liner unless the equipment is made waterproof by nature of its construction. The equipment and cells or batteries must be secured within the outer packaging and be packed so as to prevent movement, short circuits, and accidental operation during transport.

(d) Cells and batteries, for disposal or recycling. A lithium cell or battery offered for transportation or transported by motor vehicle to a permitted storage facility, disposal site or for purposes of recycling is excepted from the specification packaging requirements of paragraph (a)(4) of this section and the requirements of paragraphs (a)(1) and (a)(6) of this section when protected against short circuits and packed in a strong outer packaging conforming to the requirements of Sec. Sec. 173.24 and 173.24a.

(e) Shipments for testing (prototypes). A lithium cell or battery is excepted from the requirements of (a)(1) of this section when transported by motor vehicle for purposes of testing. The cell or battery must be individually packed in an inner packaging, surrounded by cushioning material that is non-combustible and nonconductive. The cell or battery must be transported as a Class 9 material.

(f) A lithium cell or battery that does not comply with the provisions of this subchapter may be transported only under conditions approved by the Associate Administrator.

(g) Batteries employing a strong, impact-resistant outer casing and exceeding a gross weight of 12 kg (26.5 lbs.), and assemblies of such batteries, may be packed in strong outer packagings, in protective enclosures (for example, in fully enclosed wooden slatted crates) or on pallets. Batteries must be secured to prevent inadvertent movement, and the terminals may not support the weight of other superimposed elements. Batteries packaged in this manner are not permitted for transportation by passenger aircraft, and may be transported by cargo aircraft only if approved by the Associate Administrator prior to transportation.

### **Special Provisions for Lithium batteries and cells**

**29** For transportation by motor vehicle, rail car or vessel, production runs (exceptions for prototypes can be found in Sec. 173.185(e)) of not more than 100 lithium cells or batteries are excepted from the testing requirements of Sec. 173.185(a)(1) if—

- a. For a lithium metal cell or battery, the lithium content is not more than 1.0 g per cell and the aggregate lithium content is not more than 2.0 g per battery, and, for a lithium-ion cell or battery, the equivalent lithium content is not more than 1.5 g per cell and the aggregate equivalent lithium content is not more than 8 g per battery;
- b. The cells and batteries are transported in an outer packaging that is a metal, plastic or plywood drum or metal, plastic or wooden box that meets the criteria for Packing Group I packagings; and
- c. Each cell and battery is individually packed in an inner packaging inside an outer packaging and is surrounded by cushioning material that is non-combustible, and non-conductive.

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**188** Small lithium cells and batteries. Lithium cells or batteries, including cells or batteries packed with or contained in equipment, are not subject to any other requirements of this subchapter if they meet all of the following:

- a. Primary lithium batteries and cells.

(1) Primary lithium batteries and cells are forbidden for transport aboard passenger-carrying aircraft. The outside of each package that contains primary (nonrechargeable) lithium batteries or cells must be marked "PRIMARY LITHIUM BATTERIES--FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" or "LITHIUM METAL BATTERIES--FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" on a background of contrasting color. The letters in the marking must be:

- (i) At least 12 mm (0.5 inch) in height on packages having a gross weight of more than 30 kg (66 pounds); or
- (ii) At least 6 mm (0.25 inch) on packages having a gross weight of 30 kg (66 pounds) or less, except that smaller font may be used as necessary to fit package dimensions; and

(2) The provisions of paragraph (a)(1) do not apply to packages that contain 5 kg (11 pounds) net weight or less of primary lithium batteries or cells that are contained in or packed with equipment and the package contains no more than the number of lithium batteries or cells necessary to power the piece of equipment;

- b. For a lithium metal or lithium alloy cell, the lithium content is not more than 1.0 g. For a lithium-ion cell, the equivalent lithium content is not more than 1.5 g;
- c. For a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2.0 g. For a lithium-ion battery, the aggregate equivalent lithium content is not more than 8 g;
- d. Effective October 1, 2009, the cell or battery must be of a type proven to meet the requirements of each test in the UN Manual of Tests and Criteria (IBR; see Sec. 171.7 of this subchapter);
- e. Cells or batteries are separated so as to prevent short circuits and are packed in a strong outer packaging or are contained in equipment;
- f. Effective October 1, 2008, except when contained in equipment, each package containing more than 24 lithium cells or 12 lithium batteries must be:
  - (1) Marked to indicate that it contains lithium batteries, and special procedures should be followed in the event that the package is damaged;
  - (2) 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;
  - (3) 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; and
  - 4) Gross weight of the package may not exceed 30 kg (66 pounds). This requirement does not apply to lithium cells or batteries packed with equipment;
- g. Electrical devices must conform to Sec. 173.21 of this subchapter; and
- h. Lithium batteries or cells are not authorized aboard an aircraft in checked or carry-on luggage except as provided in Sec. 175.10.

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**189** Medium lithium cells and batteries. Effective October 1, 2008, when transported by motor vehicle or rail car, lithium cells or batteries, including cells or batteries packed with or contained in equipment, are not subject to any other requirements of this subchapter if they meet all of the following:

- a. The lithium content anode of each cell, when fully charged, is not more than 5 grams.

- b. The aggregate lithium content of the anode of each battery, when fully charged, is not more than 25 grams.
- c. The cells or batteries are of a type proven to meet the requirements of each test in the UN Manual of Tests and Criteria (IBR; see Sec. 171.7 of this subchapter). A cell or battery and equipment containing a cell or battery that was first transported prior to January 1, 2006 and is of a type proven to meet the criteria of Class 9 by testing in accordance with the tests in the UN Manual of Tests and Criteria, Third Revised Edition, 1999, need not be retested.
- 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 12 mm (0.5 inch) in height on packages having a gross weight of more than 30 kg (66 pounds); or
  - (2) At least 6 mm (0.25 inch) on packages having a gross weight of 30 kg (66 pounds) or less, except that smaller font may be used as necessary to fit package dimensions.
- f. Except when contained in equipment, each package containing more than 24 lithium cells or 12 lithium batteries must be:
  - (1) Marked to indicate that it contains lithium batteries, and that special procedures should be followed in the event that the package is damaged;
  - (2) Accompanied by a document indicating that the package contains lithium batteries and that special procedures should be followed in the event that the package is damaged;
  - (3) 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; and
  - (4) Gross weight of the package may not exceed 30 kg (66 pounds). This requirement does not apply to lithium cells or batteries packed with equipment.
- g. Electrical devices must conform to Sec. 173.21 of this subchapter.

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**190** Until the effective date of the standards set forth in Special Provision 189, medium lithium cells or batteries, including cells or batteries packed with or contained in equipment, are not subject to any other requirements of this subchapter if they meet all of the following:

a. Primary lithium batteries and cells.

(1) Primary lithium batteries and cells are forbidden for transport aboard passenger-carrying aircraft. The outside of each package that contains primary (nonrechargeable) lithium batteries or cells must be marked "PRIMARY LITHIUM BATTERIES--FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" or "LITHIUM METAL BATTERIES--FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT" on a background of contrasting color. The letters in the marking must be:

(i) At least 12 mm (0.5 inch) in height on packages having a gross weight of more than 30 kg (66 pounds); or

(ii) At least 6 mm (0.25 inch) on packages having a gross weight of 30 kg (66 pounds) or less, except that smaller font may be used as necessary to fit package dimensions; and

(2) The provisions of paragraph (a)(1) do not apply to packages that contain 5 kg (11 pounds) net weight or less of primary lithium batteries or cells that are contained in or packed with equipment and the package contains no more than the number of lithium batteries or cells necessary to power the piece of equipment.

b. The lithium content of each cell, when fully charged, is not more than 5 grams.

c. The aggregate lithium content of each battery, when fully charged, is not more than 25 grams.

d. The cells or batteries are of a type proven to meet the requirements of each test in the UN Manual of Tests and Criteria (IBR; see Sec. 171.7 of this subchapter). A cell or battery and equipment containing a cell or battery that was first transported prior to January 1, 2006 and is of a type proven to meet the criteria of Class 9 by testing in accordance with the tests in the UN Manual of Tests and Criteria, Third Revised Edition, 1999, need not be retested.

e. Cells or batteries are separated so as to prevent short circuits and are packed in a strong outer packaging or are contained in equipment.

f. Electrical devices must conform to Sec. 173.21 of this subchapter.

**A54** Lithium batteries or lithium batteries contained or packed with equipment that exceed the maximum gross weight allowed by Column (9B) of the § 172.101 Table may only be transported on cargo aircraft if approved by the Associate Administrator.

**A55** Prototype lithium batteries and cells that are packed with not more than 24 cells or 12 batteries per packaging that have not completed the test requirements in Sub-section 38.3 of the UN Manual of Tests and Criteria (incorporated by reference; see § 171.7 of this subchapter) may be transported by cargo aircraft if approved by the Associate Administrator and provided the following requirements are met:

- a. The cells and batteries must be transported in rigid outer packagings that conform to the requirements of Part 178 of this subchapter at the Packing Group I performance level; and
- b. Each cell and battery must be protected against short circuiting, must be surrounded by cushioning material that is non-combustible and non-conductive, and must be individually packed in an inner packaging that is placed inside an outer specification packaging.

**A100** Primary (non-rechargeable) lithium batteries and cells are forbidden for transport aboard passenger carrying aircraft. Secondary (rechargeable) lithium batteries and cells are authorized aboard passenger carrying aircraft in packages that do not exceed a gross weight of 5 kg.

**A101** A primary lithium battery or cell packed with or contained in equipment is forbidden for transport aboard a passenger carrying aircraft unless the equipment and the battery conform to the following provisions and the package contains no more than the number of lithium batteries or cells necessary to power the intended piece of equipment:

- (1) The lithium content of each cell, when fully charged, is not more than 5 grams.
- (2) The aggregate lithium content of the anode of each battery, when fully charged, is not more than 25 grams.
- (3) The net weight of lithium batteries does not exceed 5 kg (11 pounds).

**A103** Equipment is authorized aboard passenger carrying aircraft if the gross weight of the inner package of secondary lithium batteries or cells packed with the equipment does not exceed 5 kg (11 pounds).

**A104** The net weight of secondary lithium batteries or cells contained in equipment may not exceed 5 kg (11 pounds) in packages that are authorized aboard passenger carrying aircraft.