



Department of Transportation  
**Federal Aviation Administration**  
Aircraft Certification Service  
Washington, D.C.

**TSO-C179**

Effective  
Date: 08/22/06

# Technical Standard Order

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## Subject: Rechargeable Lithium Cells and Lithium Batteries

1. **PURPOSE.** This technical standard order (TSO) is for manufacturers and designers of rechargeable lithium cells and lithium batteries applying for a TSO authorization or letter of design approval. In it, we (the Federal Aviation Administration, or FAA) tell you what minimum performance standards (MPS) your cells and batteries must first meet for approval and identification with the applicable TSO marking.
2. **APPLICABILITY.** This TSO affects new applications submitted after its effective date. Major design changes to rechargeable lithium cells and lithium batteries approved under this TSO will require a new authorization. See Title 14 of the Code of Federal Regulations (14 CFR) § 21.611(b).
3. **REQUIREMENTS.** New models of rechargeable lithium cells and single-cell batteries manufactured on or after the effective date of this TSO must meet the MPS in Underwriter Laboratories' (UL) 1642, *Standard for Safety for Lithium Batteries*, fourth edition, dated September 19, 2005. New models of lithium rechargeable multi-cell batteries must also be tested in accordance with appendix 1 of this TSO.
  - a. **Functionality.** This TSO's standards apply to rechargeable lithium cells and lithium batteries intended to provide power for aircraft equipment, including emergency systems.
  - b. **Failure Condition Classification.** Failure of the function defined in paragraphs 3 and 3a of this TSO is a *major* failure condition. You must develop cells and batteries to, at least, the design assurance level equal to this failure condition classification.
  - c. **Functional Qualification.** Demonstrate the required performance under the test conditions in UL 1642, Sections 10-19.
  - d. **Environmental Qualification.** Test the equipment according to RTCA, Inc. document RTCA/DO-160E, *Environmental Conditions and Test Procedures for Airborne Equipment*, dated December 9, 2004, or the most current revision.

e. **Deviations.** We have provisions for using alternate or equivalent means of compliance to the criteria in the MPS of this TSO. If you invoke these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation under 14 CFR § 21.609 before submitting your data package.

4. **MARKING.** Mark each cell or battery permanently and legibly with all the information in 14 CFR § 21.607(d) and UL 1642, Section 20.

5. **APPLICATION DATA REQUIREMENTS.** Under 14 CFR § 21.605(a)(2), as a manufacturer-applicant, you must give the FAA's aircraft certification office (ACO) manager responsible for your facilities, one copy each of the following technical data to support our design and production approval:

a. Operating instructions and equipment limitations in an installation/instruction manual (IM), sufficient to describe the cell or battery's operational capability. Describe any deviations in detail. If needed, identify the cell or battery by part number, version, revision, and criticality level of software/hardware, classification for use, and environmental categories.

b. Installation procedures and limitations in an IM, sufficient to ensure that the cells or batteries, when installed according to the installation procedures, still meet this TSO's requirements. The limitations must identify any unique aspects of the installation. Finally, the limitations must include a note with the following statement:

The conditions and tests for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR part 43 or the applicable airworthiness requirements.

- c. Schematic drawings of the installation procedures.
- d. Wiring diagrams of the installation procedures.
- e. List of components, by part number, that make up the cells or batteries complying with the standards in this TSO. Include vendor part number cross-references, when applicable.
- f. A component maintenance manual (CMM), covering periodic maintenance, calibration, and repair, for the continued airworthiness of installed cells and batteries. Include recommended inspection intervals and service life. Describe the details of deviations granted, as noted in paragraph 5a of this TSO.
- g. Material and process specifications list.

**h.** The quality control system description required by 14 CFR §§ 21.143 and 21.605(a)(3) including functional test specifications. The QCS should ensure that you will detect any change to the cell or battery that could adversely affect compliance with the TSO MPS, and reject the item accordingly. (Not required for LODA applicants.)

**i.** Manufacturer's TSO qualification test report.

**j.** Nameplate drawing with the information required by paragraph **4** of this TSO.

**k.** List of all drawings and processes (including revision level), to define the article's design. For a minor change, follow the directions in 14 CFR § 21.611(a). Show any revisions to the drawing list only on our request.

**l.** An environmental qualifications form as described in RTCA/DO-160E for each component of the system.

**6. MANUFACTURER DATA REQUIREMENTS.** Besides the data given directly to the FAA, a manufacturer must have the following technical data available for review by the responsible ACO:

**a.** The functional qualification specifications for qualifying each production article to ensure compliance with this TSO.

**b.** Equipment calibration procedures.

**c.** Corrective maintenance procedures within 12 months after TSO authorization.

**d.** Schematic drawings.

**e.** Wiring diagrams.

**f.** Material and process specifications.

**g.** The results of the environmental qualification tests conducted per RTCA/DO-160E or the most current revision.

**7. FURNISHED DATA REQUIREMENTS.** If furnishing one or more articles to one entity (such as an operator or repair station), provide one copy of the data in paragraphs **5a** through **5g** of this TSO for each article manufactured under this TSO:

**8. HOW TO GET REFERENCED DOCUMENTS.**

**a.** Order RTCA documents from RTCA Inc., 1828 L Street, N.W., Suite 805, Washington, DC 20036-4001. Telephone (202) 833-9339, fax (202) 833-9434. You can also order copies from the RTCA Internet website at [www.rtca.org](http://www.rtca.org).

**b.** Order UL standards from COMM 2000, 1414 Brook Drive, Downers Grove, IL 60515. Telephone 888-853-3503. You can also order copies through the Internet website at <http://www.comm-2000.com>.

**c.** Order copies of 14 CFR part 21 from the Superintendent of Documents, Government Printing Office, P.O. Box 37154, Pittsburgh PA 15250-7954. Telephone (202) 512-1800, fax (202) 512-2250. You can also order copies from the Government Printing Office (GPO) Internet website at [www.access.gpo.gov](http://www.access.gpo.gov). Select "Access," then "Online Bookstore." Select "Aviation," then scroll to "Code of Federal Regulations."

**d.** You can find a current list of technical standard orders on the FAA Internet website Regulatory and Guidance Library at [www.airweb.faa.gov/rgl](http://www.airweb.faa.gov/rgl). You will also find the TSO Index of Articles at the same site.

/s/ ***Susan J. M. Cabler***

Susan J. M. Cabler  
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**APPENDIX 1. MINIMUM PERFORMANCE  
STANDARD (MPS) FOR LITHIUM MULTI-CELL BATTERIES**

**1-1. PURPOSE.** This appendix prescribes additional MPS for rechargeable lithium batteries that have two or more cells.

**1-2. REQUIREMENTS.** Table 1 prescribes tests that must be performed on batteries with two or more cells. **WARNING:** Protect personnel from flying fragments, explosive force, sudden release of heat and noise, and harmful fumes or gases.

<b>Table 1. TESTS FOR FIRE SAFETY REQUIREMENTS</b>		
<b>Test</b>	<b>Procedures</b>	<b>Criteria to Pass</b>
External Short Circuit	Measure direct connection between terminals through electric wire with resistance of 2m-ohm. State of Charge (SoC) of a cell : 100%	No venting of gases/vapors. No smoke produced. No ignition or fire. No explosion.
Crush	Test battery by dropping an iron ball (9.1 kg) from the height of 61cm SoC of a cell : 100%	No venting of gases/vapors. No smoke produced. No ignition or fire. No explosion.
Over discharge	Test battery by discharging with a current of 1A for 1 hour (or to the maximum discharge time for the battery operation). SoC of a cell : 100%	No venting of gases/vapors. No smoke produced. No ignition or fire. No explosion.
Overheat	Test battery by heating up to 115 degrees C in the oven. SoC of a cell : 100%	No venting of gases/vapors. No smoke produced. No ignition or fire. No explosion.
Fire	Test equipment unit with battery in place for fire penetration by igniting a single unit.  SoC of a cell : 100%	Unit must contain the fragments/debris from explosion but not gases/vapors/smoke. Fire within the unit must self-extinguish. Note that a fire extinguishing or suppression system outside the battery (such as in the equipment compartment) may be used to provide this feature if the system is designed to handle this fire threat.