



Number: CTSO-C142b

Date of approval: September 7, 2022

Approved by: Yang Zhenmei

China Civil Aviation Technical Standard Order

This China Civil Aviation Technical Standard Order (CTSO) is issued according to Part 37 of the China Civil Aviation Regulations (CCAR-37). Each CTSO is a criterion which the concerned aeronautical materials, parts or appliances used on civil aircraft must comply with when it is presented for airworthiness certification.

Non-Rechargeable Lithium Cells and Batteries

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is applicable to the manufacturer that applies for CTSO authorization (CTSOA) for non-rechargeable lithium cells and batteries. This CTSO specifies the minimum operational performance standards (MOPS) that non-rechargeable lithium cells and batteries must meet in order to be approved and identified with the applicable CTSO markings.

2. Applicability.

This CTSO affects new applications submitted after its effective date.

a. From the effective date of this CTSO, applicants who wish to obtain the CTSOA of non-rechargeable lithium cells and batteries should submit applications in accordance with this CTSO. CTSO-C142a will also remain effective until 6 months from this CTSO release. After this

date, Civil Aviation Administration of China (CAAC) will no longer accept new applications for CTSO-C142a.

b. From the effective date of this CTSO, equipment that was approved under CTSO-C142a may still be manufactured under the provisions of its original approval.

c. Major design changes to article approved under this CTSO will require a new authorization in accordance with Section 21.353 of CCAR-21-R4.

d. This CTSO is not applicable to coin or button cells which have an energy rating of less than 2Wh.

3. Requirements.

New models of non-rechargeable lithium cells and batteries identified and manufactured on or after the effective date of this CTSO must meet the requirements in Sections 1 and 2 of RTCA/DO-227A, *Minimum Operational Performance Standards for Non-Rechargeable Lithium Batteries*, dated September 21, 2017, as amended by Appendix of this CTSO.

a. Functionality.

This CTSO applies to non-rechargeable lithium cells and batteries which are intended to provide power for aircraft equipment, including emergency systems.

b. Failure Condition Classifications.

There is no standard minimum failure condition classification for this CTSO. The failure condition classification appropriate for the equipment will depend on the intended use of the equipment in a specific aircraft. Document the loss of function and malfunction failure condition classification when the equipment is designed.

c. Functional Qualification.

Demonstrate the required performance according to the test conditions specified in Section 2 of RTCA/DO-227A, *Minimum Operational Performance Standards for Non-Rechargeable Lithium Batteries*, dated September 21, 2017.

d. Environmental Qualification.

Demonstrate the required performance according to the test conditions specified in Section 2 of RTCA/DO-227A, *Minimum Operational Performance Standards for Non-Rechargeable Lithium Batteries*, dated September 21, 2017.

e. Software Qualification.

If the article includes software, develop the software according to RTCA/DO-178C, *Software Considerations in Airborne Systems and Equipment Certification*, dated December 13, 2011, including referenced supplements as applicable, to at least the development assurance level consistent with the failure condition classification defined in Paragraph 3.b of this CTSO. If RTCA/DO-178B, dated December 1, 1992, is used

as a method of software development compliance, CAAC reserves the right to require applicants to meet additional requirements in addition to RTCA/DO-178B.

f. Electronic Hardware Qualification.

If the article includes complex custom airborne electronic hardware, develop the component according to RTCA/DO-254, *Design Assurance Guidance for Airborne Electronic Hardware*, dated April 19, 2000, to at least the design assurance level consistent with the failure condition classification defined in Paragraph 3.b of this CTSO. For custom airborne electronic hardware determined to be simple, Section 1.6 of RTCA/DO-254 applies.

g. Deviations.

For using alternative or equivalent means of compliance to the criteria in the MOPS of this CTSO, the applicant must show that the equipment maintains an equivalent level of safety. Apply for a deviation pursuant to Section 21.368(a) in CCAR-21-R4.

4. Marking.

a. Mark at least one major component permanently and legibly with all of the information in Section 21.423(b) of CCAR-21-R4 and Section 2.1.10 of RTCA/DO-227A, *Minimum Operational Performance Standards for Non-Rechargeable Lithium Batteries*, dated September 21, 2017.

b. The non-rechargeable lithium cell, battery or end item must be marked in accordance with the following table:

Mark the CTSO as CTSO-C142b-X in accordance with the following table:

X	Cell, Battery or End Item
-1	Cell
-3	Battery
-5	End Item
-7	<5Wh (End Item) Cells and batteries must meet at a minimum UL1642 and UN38.3 certification. (see note below)

Note: For CTSO-142b-7 approvals, the CTSO marking must be made on the End Item. Any cell or battery within the End Item must be separately marked and identified as a component of the End Item. A clear note must be included in the manufacturer's documentation that the cell or battery is not to be used in any other End Item unless it is tested separately for that End Item. The End Item is required to meet the requirements of this CTSO, and the configuration control documentation must state that the cell or battery is approved based solely on the fact that it is tested and validated within the approved End Item. Only cells or batteries that are approved under the CTSO-C142b End Item article may be used. Do not

use any other cell or battery without the approval of manufacturer of the article. If a different cell or battery is to be used with this End Item, the manufacturer must submit a new CTSO application (for the End Item) to CAAC.

c. If the article includes software and/or airborne electronic hardware, the article part numbering scheme must identify the software and airborne electronic hardware configuration and can use separate, unique part numbers for software, hardware, and airborne electronic hardware.

d. The applicant may use electronic part marking to identify software or airborne electronic hardware components by embedding the identification within the hardware component itself (using software) rather than marking it on the equipment nameplate. If electronic marking is used, it must be readily accessible without the use of special tools or equipment.

5. Application Data Requirements.

The applicant must give CAAC a statement of conformance, pursuant to Section 21.353(a)(1) in CCAR-21R4 and one copy each of the following technical data to support the design and production approval.

a. Manuals containing the following:

(1) Operating instructions and equipment limitations sufficient to describe the equipment's operational capability.

(2) Abstracts of test results including approved or unapproved criteria and information to be reported, required by Section 3 of this CTSO.

(3) Detailed description of all deviations.

(4) Installation procedures and limitations sufficient to ensure that the airborne multipurpose electronic display, when installed according to installation or operational procedures, still meets this CTSO's requirements. Limitations must identify any unique aspects of the installation. The limitations must also include a note with the following statement:

“This article meets the minimum operational performance and quality control standards required by a CTSO. Installation of this article requires separate approval.”

(5) For each unique configuration of software and airborne electronic hardware, reference the following:

(i) Software part number including revision and design assurance level;

(ii) Airborne electronic hardware part number including revision and design assurance level;

(iii) Functional description.

(6) A summary of the test conditions used for environmental qualifications for each component of the article. For example, use the

form as described in RTCA/DO-160G, *Environmental Conditions and Test Procedures for Airborne Equipment*, Appendix A.

(7) Schematic drawings, wiring diagrams, and any other documentation necessary for installation of non-rechargeable lithium cells and batteries.

(8) By-part-number list of replaceable components that makes up the non-rechargeable lithium cells and batteries. Include vendor part number cross-references, when applicable.

b. Instruction of continued airworthiness, including the requirements for periodic maintenance, calibration and repair of equipment, to ensure that the non-rechargeable lithium cells and batteries continues to meet the CTSO approved design. If applicable, the recommended inspection interval and service life should be included.

c. If the article includes software: a plan for software aspects of certification (PSAC), software configuration index, and software accomplishment summary.

d. If the article includes simple or complex electronic hardware: a plan for hardware aspects of certification (PHAC), hardware verification plan, top-level drawing, and hardware accomplishment summary (or similar document, as applicable).

e. A drawing depicting how the article will be marked with the information required by Section 4 of this CTSO.

f. The quality system description required by Section 21.358 of CCAR-21R4, including functional test specifications. The quality system must ensure that any change to the approved design that could adversely affect compliance with the CTSO MOPS should be detected, and the article be rejected accordingly.

g. A description of the organization including information required by Section 21.355 of CCAR-21-R4.

h. Material and process specifications list.

i. List of all drawings and processes (including revision level) that define the article's design.

j. Manufacturer's CTSO qualification report showing results of testing accomplished according to Paragraph 3.c of this CTSO.

k. A copy of the test results including method, data and report of the test according to Section 3 of this CTSO.

6. Manufacturer Data Requirements.

Besides the data given directly to CAAC, have the following technical data available for review by CAAC:

a. Functional qualification specifications for qualifying each production article to ensure compliance with this CTSO.

b. Article calibration procedures.

c. Schematic drawings.

d. Wiring diagrams.

- e. Material and process specifications.
- f. The results of the environmental qualification tests conducted according to Paragraph 3.d of this CTSO.
- g. If the article includes software, the appropriate documentation defined in RTCA/DO-178C or RTCA/DO-178B specified in Paragraph 3.e of this CTSO, including all data supporting the applicable objectives specified by RTCA/DO-178C or RTCA/DO-178B, Annex A, Process Objectives and Outputs by Software Level.
- h. If the article includes complex custom airborne electronic hardware, the appropriate hardware life-cycle data in combination with design assurance level, as defined in RTCA/DO-254, Appendix A, Table A-1. For simple custom airborne electronic hardware, the following data are required: test cases or procedures, test results, test coverage analysis, tool assessment and qualification data, and configuration management records, including problem reports.

7. Furnished Data Requirements.

- a. When furnishing one or more articles manufactured under this CTSO to one entity (such as an operator or repair station), provide one copy access to the data in Paragraphs 5.a and 5.b of this CTSO. Add any other data needed for the proper installation, certification, use, or continued airworthiness of the article.
- b. If the article contains software, include one copy of the abstract of

the Open Problem Report (OPR) on functional inputs.

8. Availability of Referenced Documents.

Order RTCA documents from

Radio Technical Commission for Aeronautics, Inc.

1150 18th Street NW, Suite 910, Washington D.C. 20036

Copies can be ordered online at www.rtca.org.

Appendix. Minimum Operational Performance Standards for Non-rechargeable Lithium Cells and Batteries

This appendix specifies modifications made by CAAC to the MOPS of this CTSO that non-rechargeable cells and batteries must meet. The standards are modified as follows:

RTCA/DO-227A Section and Title	Current Wording	Modified Wording
1.4 Specific Exclusions from This Document	Cells or batteries containing less than 2 Watt-hours (Wh) of capacity have sufficiently low energy that the possible hazard is considered low and therefore these cells and batteries are assessed as presenting an acceptably low risk for installation as long as they are compliant with the requirements of UL 1642. If compliant with UL 1642 and the UN transport regulations, no other requirements from this MOPS will apply to cells or batteries with less than 2 Wh of capacity.	Coin or button cells containing less than 2 Watt-hours (Wh) of capacity have sufficiently low energy that the possible hazard is considered low and therefore these cells and batteries are assessed as presenting an acceptably low risk for installation as long as they are compliant with the requirements of UL 1642. If compliant with UL 1642 and the UN transport regulations, no other requirements from this MOPS will apply to coin or button cells with less than 2 Wh of capacity.
Non-rechargeable cells or batteries with less than 5 Wh of capacity, and those that have not been tested under Sections 1.0 and 2.0 of RTCA/DO-227A		This CTSO's requirements can be met via the test of End Items as discussed in Sections 2.2.3 and 2.4.3 of RTCA/DO-227A, <i>Minimum Operational Performance Standards (MOPS) for Non-Rechargeable Lithium Batteries</i> , dated September 21, 2017. Cells or batteries should be marked as required in Paragraph 4.b of this CTSO (CTSO-C142b-7). Note: For CTSO-142b-7 approvals,

		<p>the CTSO marking must be made on the End Items and cells or batteries. A clear note must be included in the manufacturer's documentation that the cell or battery is not to be used in any other End Item. The End Item is required to meet the requirements of this CTSO, and the configuration control documentation must state that the cell or battery is approved based solely on the fact that it is tested and validated within the approved End Item. Only cells or batteries that are approved under the CTSO-C142b End Item article may be used. Do not use any other cell or battery without the approval of the manufacturer of the article. If a different cell or battery is to be used with this End Item, the manufacturer must submit a new CTSO application to CAAC.</p>
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The English version is for reference only. In case of any discrepancy or ambiguity of meaning between this English translation and the Chinese version, the latter shall prevail.