



Number: CTSO-C178

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Approved by: Xu Chaoqun

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.

Single Phase 115 VAC, 400 Hz Arc Fault Circuit Breakers

1. Purpose.

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers applying for single phase 115 VAC, 400 Hz arc fault circuit breakers (AFCBs) CTSO authorization (CTSOA). This CTSO prescribes the minimum performance standards(MPS) that AFCB must first meet for approval and identification with the applicable CTSO marking.

2. Applicability.

This CTSO affects new application submitted after its effective date. Major design changes to article approved under this CTSO will require a new authorization in accordance with section 21.353 of CCAR-21R4.

3. Requirements

New models of AFCBs identified and manufactured on or after the

effective date of this CTSO must meet the MPS in SAE International's Aerospace Standard (AS) 5692, Arc Fault Circuit Breaker (AFCB), Aircraft, Trip-Free Single Phase 115 Vac, 400 Hz-Constant Frequency, dated October 2004, and the additional requirements of this document

a. Functionality. This TSO's standards apply to equipment intended to provide an equivalent level of thermal protection of existing thermal circuit breakers, with the additional capability to detect and react to arc fault conditions, thus diminishing damage to wiring systems by prolonged arcing, which could start a fire.

b. Additional Functional Requirements. AFCBs may have separate indication of thermal and arcing faults to assist in fault isolation and performing proper repairs.

c. Failure Condition Classifications.

Failure of the function defined in paragraph 3.a of this CTSO is a major failure condition. Develop the system to, at least, the design assurance level equal to this failure condition classification.

NOTE: A major failure condition reduces the ability of the airplane or the crew to cope with adverse operating conditions. There is a significant reduction in safety margins or functional capabilities; a significant increase in crew workload or in conditions impairing crew efficiency; discomfort to the flight crew or physical distress to passengers or cabin crew, possibly including injuries.

d. Functional Qualification. Demonstrate the required performance under the test conditions and procedures specified in SAE AS 5692, Section 4.

e. 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 most current revision..

f. Software Qualification. If the article includes a digital computer, develop the software according to RTCA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification, dated December 1, 1992.

g. Electronic Hardware Qualification. If the article includes aircraft products or appliances incorporating custom micro-coded components, such as application specific integrated circuits (ASIC), programmable logic devices (PLD), field programmable gate arrays (FPGA), or similar electronic components in the design, develop the hardware using RTCA, Inc., Document RTCA/DO-254, Design Assurance Guidance for Airborne Electronic Hardware.

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

4. Marking.

a. Mark at least one major component permanently and legibly with all the information in 21.423(b) of CCAR-21R4.

(1) Use the name, type, and part number. Do not use the optional model number;

(2) Use the date of manufacture. Do not use the optional serial number.

b. Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, and the CTSO number:

(1) Each component that is easily removable (without hand tools);

(2) Each interchangeable element;

(3) Each subassembly of the article that manufacturer determined may be interchangeable.

c. If the component includes a digital computer, then the part number must include hardware and software identification. Or, you can use a separate part number for hardware and software. Either way, you must include a means to show the modification status.

NOTE: Similar software versions, approved to different software levels, must be differentiated by different part numbers.

d. If applicable, identify deviations granted to the article by marking "Deviation. See installation/instruction manual (IM)" after the TSO

number. You may abbreviate the marking to “Dev. See IM.”

e. When applicable, identify the equipment as an incomplete system or that the appliance performs functions beyond those described in paragraphs 3 and 3.a of this TSO.

5. Application Data Requirements.

The applicant must furnish the responsible certification personnel with the related data to support design and production approval. The application data include a statement of conformance as specified in section 21.353(a)(1) in CCAR-21R4 and one copy each of the following technical data:

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

b. Installation procedures and limitations in an IM, sufficient to ensure that the AFCB, when installed according to the installation procedures, still meets this CTSO’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 CTSO 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 CTSO standards. CTSO articles must have separate approval for installation in an aircraft.

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 arc fault circuit breaker complying with the standards in this CTSO. 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 the AFCB. Include recommended inspection intervals and service life. Describe the details of deviations granted, as noted in paragraph 5.a of this CTSO.

g. Material and process specifications list.

h. The quality system description required by section 21.358 of CCAR-21R4, including functional test specifications. The quality system should ensure that it will detect any change to the approved design that could adversely affect compliance with the CTSO MPS, and reject the article accordingly.

i. Manufacturer's CTSO qualification test report.

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

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

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

m. If the article includes a digital computer: a Plan for Software Aspects of Certification (PSAC), software configuration index, and software accomplishment summary. We recommend that you submit the PSAC early in the software development process. Early submittal allows us to quickly resolve issues, such as partitioning, determining software levels, and other concerns that may occur.

n. If the article includes a complex custom micro-coded component: a Plan for Hardware Aspects of Certification (PHAC), hardware verification plan, top-level drawing, and hardware accomplishment summary.

6. Manufacturer Data Requirements.

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

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

- 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.
- h. If the article includes a digital computer, the appropriate documentation defined in RTCA/DO-178B, including all data supporting the applicable objectives in RTCA/DO –178B, Annex A, Process Objectives and Outputs by Software Level.
- i. The appropriate hardware life cycle data consummated with design assurance level as defined in RTCA/DO-254, Appendix A, Table A-1, if the article includes a complex custom micro-coded component.

7. Furnished Data Requirements.

If furnishing one or more articles to one entity (such as an operator or repair station), provide the following for each article manufactured under this CTSO:

- a. One copy of the data in paragraphs 5.a through 5.f of this CTSO and any other data needed for the proper installation, certification, and

use or continued airworthiness of AFCBs.

b. One copy of the data in paragraphs 5.k through 5.n, if the appliance performs functions beyond those described in paragraph 3.a of this CTSO.

8. Availability of Referenced Documents.

a. Order SAE documents from:

SAE International

400 Commonwealth Drive, Warrendale, PA 15096-0001

You may also order them online from the SAE Internet website at:

www.sae.org

b. Order RTCA documents from:

Radio Technical Commission for Aeronautics, Inc.

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

You may also order them online from the RTCA Internet website at:

www.rtca.org.