



ITSO-C106

Effective

Date: 13-02-2019

**Government of India**  
Directorate General of Civil Aviation  
Aircraft Engineering Directorate  
New Delhi-110003

# Indian Technical Standard Order

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**Subject: Air Data Computer (ADC)**

**1. PURPOSE:** This Indian Technical Standard Order (ITSO) is for manufacturers of Air Data Computer applying for an ITSO Authorization (ITSOA).

**2. APPLICABILITY:** This ITSO affect applications submitted after its effective date.

**3. REQUIREMENTS:** The ADC, identified and manufactured under this ITSO must meet the Minimum Performance Standard (MPS) qualification set forth in the Society of Automotive Engineers, Inc. (SAE), Aerospace Standard (AS) document No. AS 8002, Revision A, dated 01<sup>st</sup> September 1996 "Air Data Computer - Minimum Performance Standard".

**a) Functionality:** This ITSO standard covers air data computer equipment which when connected to sources of aircraft electrical power, static pressure, total pressure, outside air temperature and others specified by the manufacturer (single or in combination) provides computed air data output signals (in analog/digital form) which may supply primary flight instrument.

**b) Failure Condition Classifications:** There is no standard minimum failure condition classification for this ITSO. The failure condition classification appropriate for the equipment will depend on the intended use of the equipment in a specific aircraft. Applicant shall document the loss of function and malfunction failure condition classification for which the equipment is designed.

**c) Functional Qualification:** ADC must qualify to the performance standards as specified in SAE AS8002 REV A. The required performance must be demonstrated by using the test conditions specified in SAE AS8002REV A.

**d) Environmental Standard:** Demonstrate the required performance for tests specified in Section 5 of SAE AS8002 Rev.A using the conditions and procedures prescribed in RTCA/DO-160G, "Environmental Conditions and Test Procedures for Airborne Equipment," dated 08<sup>th</sup> December 2010 in lieu of RTCA/DO-160A,

dated January 1980, which is incorporated as a reference in SAE AS 8002 Rev.A.

Different standard for environmental condition and test procedure than RTCA/DO-160G may be used, provided the standard is appropriate for the ADC.

**e) Deletion:** Paragraph 4.2 of SAE AS8002, Rev. A.

**f) Addition:** The following shall be used in place of paragraph 4.2

**Static Source Error Correction (if applicable)**

Unless otherwise noted, outputs may be corrected for static source errors of the specific aircraft model in which the computer is intended to be used.

The tolerance of the correction value produced from the correction profile (correction curve) residing in the computer shall be the sum of the following:

- i.  $\pm 15\%$  of theoretical value of correction or equivalent of  $\pm 0.0025$  in Hg static pressure, whichever is greater.
- ii. Value of correction curve slope times the tolerance of independent variable programming the correction curve.

When testing corrected parameters (altitude, airspeed or Mach) the nominal value of the parameter at each test point indicated in Tables 1, 3 or 4 shall be adjusted to include the correction value with tolerance limits set per (A) and (B) above.

**g) Exception:** TABLE 3, CALIBRATED AIRSPEED: A looser tolerance of plus or minus  $\pm 6.5$  km/h (3.5 knots) may be used at the 148 km/h (80 knots) reference point.

**h) Computer Software:** If the article includes software, one acceptable means of compliance for the development of the airborne software is RTCA/DO-178C, "Software Considerations in Airborne Systems and Equipment Certification" dated 13<sup>th</sup> December 2011, including referenced supplements as applicable. Develop the software at least to the level consistent with the failure condition classification defined in paragraph 3.b of this ITSO.

**Note 1:** The certification liaison process objectives will be considered satisfied after DGCA review of the applicable life cycle data.

**Note 2:** DGCA recommends early discussion between the applicant and the DGCA on the applicant's proposed software verification and validation plan, and the applicant's proposed software level or levels.

**i) Electronic Hardware Qualification:** If the article includes complex custom airborne electronic hardware, one acceptable means of compliance for the development of component is according to RTCA/DO-254 "Design Assurance Guidance for Airborne Electronic Hardware" dated 19<sup>th</sup> April 2000. Develop the Hardware at least to the design assurance level consistent with the failure

condition classification defined in paragraph 3.b of this ITSO. For custom airborne electronic hardware determined to be simple, RTCA/DO-254, paragraph 1.6 applies.

**Note:** The certification liaison process objectives will be considered satisfied after DGCA review of the applicable life cycle data.

**j) Deviations:** The DGCA has provisions for alternate or equivalent means of compliance to the criteria in the MPS of this ITSO. Manufacturers invoking these provisions must demonstrate that their equipment maintains an equivalent level of safety and must apply for a deviation under the provision of CAR 21.610.

**4. Marking:** Parts manufactured under this ITSO must be permanently and legibly marked in accordance with CAR 21.807 and paragraph 9.2 of SAE AS8002 Rev.A.

**a)** If the article includes software and/or airborne electronic hardware, then the article part numbering scheme must identify the software and airborne electronic hardware configuration. The part numbering scheme can use separate, unique part numbers for software and airborne electronic hardware. Either approach must include a means to show level to which the software and/or airborne electronic hardware has been verified and validated & modification status.

**b)** Each separate component of equipment that is manufactured under this ITSO (antenna, receiver, sensors, display panels, etc.) must be permanently and legibly marked with at least the name of the manufacturer and the ITSO number.

**c)** Electronic part marking may be used 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 submit the DGCA (AED), a Statement of Compliance (Form CA-35 of CAR 21) along with documents required under CAR 21.605 and one copy of each of the following technical data in support of design & production capability:

**a)** A Manual(s) containing the following:

**i)** Operating instructions and article limitations sufficient to describe the equipment's operational capability

**ii)** Describe in detail any deviations.

**iii)** Installation procedures and limitations sufficient to ensure that the ADC, when installed according to the installation or operational procedures, still meets this ITSO's requirements. Limitations must identify any unique

aspects of the installation. The limitations must include a note with the following statement:

**“This article meets the minimum performance and quality control standards required by an Indian technical standard order (ITSO). Installation of this article requires separate approval.”**

- iv) For each unique configuration of software and airborne electronic hardware, reference the following:
  - Software part number including revision and design assurance level;
  - Airborne electronic hardware part number including revision and design assurance level; and,
  - Functional description.
- v) A summary of the test conditions used for environmental qualifications for each component of the article. For example, a form as described in RTCA DO-160G “Environmental Conditions and Test Procedures for Airborne Equipment” Appendix A.
- vi) Schematic drawings, wiring diagrams, and any other documentation necessary for installation of the ADC.
- vii) List of the major components replaceable components, by part number, that makes up the ADC. Include vendor part number cross-references, when applicable.
- b) Instructions covering periodic maintenance, calibration, and repair, to ensure that the ADC continues to meet the ITSO approved design. Include recommended inspection intervals and service life, as appropriate.
- 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 custom airborne 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 paragraph 4 of this ITSO.
- f) Identify functionality or performance contained in the article not evaluated under paragraph 3 of this ITSO (that is, non-ITSO functions). Non-ITSO functions are accepted in parallel with the TSO authorization. For those non-ITSO functions to be accepted, you must declare these functions and include the following information with your ITSO application:

1. Description of the non- ITSO function(s), such as performance specifications, failure condition classifications, software, hardware, and environmental qualification levels. Include a statement confirming that the non-ITSO function(s) do not interfere with the article's compliance with the requirements of paragraph 3.

2. Installation procedures and limitations sufficient to ensure that the non-ITSO function(s) meets the declared functions and performance specification(s) described in paragraph 5.f. (1).

3. Instructions for continued performance applicable to the non-ITSO function(s) described in paragraph 5.f. (1).

4. Interface requirements and applicable installation test procedures to ensure compliance with the performance data defined in paragraph 5.f. (1).

5. Test plans, analysis and results, as appropriate, to verify that performance of the hosting ITSO article is not affected by the non-ITSO function(s).

6. Test plans, analysis and results, as appropriate, to verify the function and performance of the non-ITSO function(s) as described in paragraph 5.f. (1).

g) Material and process specifications list.

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

i) Manufacturer's ITSO qualification report showing results of testing accomplished according to paragraph 3.C of this ITSO.

**6. MANUFACTURER DATA REQUIREMENTS:** In addition to those data requirements that are to be furnished directly to the DGCA (AED), the manufacturer must have following technical data available for review by the DGCA having preview of the manufacturer's facilities :

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

b) Equipment 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.C of this ITSO.

g) If the article includes software, the appropriate documentation defined in RTCA/DO-178B or RTCA/DO-178C specified in paragraph 3.e of this ITSO, including all data supporting the applicable objectives in RTCA/DO-178B or RTCA/DO-178C 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-I. For simple custom airborne electronic hardware, the following data: test cases or procedures, test results, test coverage analysis, tool assessment and qualification data, and configuration management records, including problem reports.
- i) If the article contains non-ITSO function(s), you must also make available items 6.a through 6.h as they pertain to the non-ITSO function(s).

**7. Data to be furnished with manufactured units:** one copy of the data and information specified in paragraphs 5 (a) (i) to (iii), (v) to (viii) of this ITSO and paragraphs 5 (b) for continued airworthiness must go to each person receiving for use one or more articles manufactured under this ITSO. In addition, a note with the following statement should be included:

“The conditions and tests required for ITSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the ITSO standards. If not within the ITSO standards, the article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.”

**8. Availability of Reference Documents.**

- a) Copies of CAR 21 are available on DGCA website at [www.dgca.nic.in](http://www.dgca.nic.in)
- b) Copies of SAE Standard AS 8002 REV A may be purchased on-line through website: [www.sae.org](http://www.sae.org)
- c) Copies of RTCA documents may be purchased online through website: [www.rtca.org](http://www.rtca.org)
- d) current list of Indian Technical Standard Orders available on DGCA website at [www.dgca.nic.in](http://www.dgca.nic.in)

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