



ITSO – C150a

Effective Date: 26.12.2019

Government of India
Civil Aviation Department
Directorate General of Civil Aviation
Aircraft Engineering Directorate
New Delhi

Indian Technical Standard Order

Subject: *Aircraft Seals*

1. **PURPOSE.** This Indian Technical Standard Order (ITSO) is for manufacturers of Aircraft Seals applying for an ITSO authorization (ITSOA).
2. **APPLICABILITY.** This ITSO affects new applications submitted after its effective date.
3. **REQUIREMENTS.** New models of aircraft seals identified and manufactured on or after the effective date of this ITSO must meet the MPS qualification and documentation test requirements in appendix 1, Aircraft Seal Property Test Requirements
 - a. **Functionality.** This ITSO's standards apply to seals for static and dynamic aircraft applications in pneumatic, hydraulic, environmental, insulating, dampening, and anti-extrusion systems. This ITSO may be used to qualify a manufacturer's catalogue seals, seals of proprietary designs, and for seals used in the manufacture and maintenance of aircraft products.
 - b. **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:

- a) Parts manufactured under this ITSO must be permanently and legibly marked in accordance with CAR 21.807. The date of manufacture of the part, expected shelf life and manufacturer's inspection lot number must be on all aircraft Seals.

NOTE: When a seal is too small or otherwise impractical to mark with any of the information required by CAR 21.807, the ITSO applicant must attach that information to the part or its container

- b) Also, the following should be marked permanently and legibly, with at least the manufacturer's name, subassembly part number, and the ITSO number:

- 1) Each component that is easily removable (without hand tools), and
- 2) Each subassembly of the article that is determined to be interchangeable.

- c) The marking should include a means to indicate a deviation if granted.

- 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:

1) Operating instructions and Limitations: Applicant should provide operating instructions and limitations for each type of aircraft seal. The instructions and limitations must list the minimum counter, bend radius, maximum twist limitations, maximum operating pressure, maximum operating temperature, and fire resistance.

- 2) A description in detail of any deviations.

3) Installation procedures and limitations sufficient to ensure that the article 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."

- b) Instructions covering periodic maintenance to ensure that the aircraft seals continue to meet the ITSO approved design. Include recommended inspection intervals and service life, as appropriate.
- c) A drawing depicting how the article will be marked with the information required by paragraph 4 of this ITSO.
- d) The applicant must identify functionality or performance contained in the article not evaluated under paragraph 3(b) of this ITSO (that is, non-ITSO functions). Non-ITSO functions are accepted in parallel with the ITSO authorization. For those non-ITSO functions to be accepted, the applicant must declare these functions and include the following information with the 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.d(1).
 - 3) Instructions for continued performance applicable to the non-ITSO function(s) described in paragraph 5.d(1).
 - 4) Interface requirements and applicable installation test procedures to ensure compliance with the performance data defined in paragraph 5.d(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.d(1).
- e) The quality system description required by **CAR 21.139**, including functional test specifications. The quality system should ensure that applicant will detect any change to the approved design that could adversely affect compliance with the MPS of ITSO, and reject the article accordingly.
- f) Material and process specifications list.
- g) List of all drawings and processes (including revision level) that define the article's design.
- h) Manufacturer's ITSO qualification report showing results of testing accomplished according to paragraph 3 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 purview of the manufacturer's facilities :

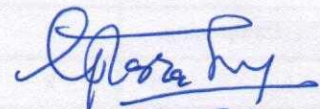
- a. Functional qualification specifications for qualifying each production article to ensure compliance with this ITSO.
- b. Dimensional drawings
- c. Material and process specifications.
- d. If the article contains non-ITSO function(s), the applicant must also make available items 6.a through 6.c as they pertain to the non-ITSO function(s).

7. **Data to be furnished with manufactured units:**

- a) One copy of the data and information specified in paragraphs 5.a(i) to (iii) 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.
- b) If the article contains declared non-ITSO function(s), one copy of the data in paragraphs 5.d.(1) through 5.d.(4) must be included.

8. Availability of Reference Documents.

- a. Copy of CAR 21 is available on DGCA website at www.dgca.nic.in
- b. American Society for Testing and Materials (ASTM) documents may be purchased from: ASTM, 100 Barr Harbor Drive, P.O Box C700 West Conshohocken, PA 19428- 2959. Copies can also be ordered online at www.astm.org.
- c. Current list of Indian Technical Standard Orders available on DGCA website at www.dgca.nic.in.



(G. Rajasekar)

Joint Director General
For Director General of Civil Aviation

APPENDIX 1. AIRCRAFT SEAL PROPERTIES TEST REQUIREMENTS

Seal Type	Table 1 Material Properties							
	Hardness		Specific Gravity		Tensile Strength at Break		Ultimate Elongation	
	Plastic	Rubber	Plastic	Rubber	Plastic	Rubber	Plastic	Rubber
Pneumatic	X	X	X	X	X	X	X	X
Hydraulic	X	X	X	X	X	X	X	X
Environmental	X	X	X	X	X	X	X	X
Insulating	X	X	X	X	X	X	X	X
Dampening	X	X	X	X	X	X	X	X
Anti-Extrusion	X	X	X	X	X	X	X	X
ASTM Test Method								
Applicable Documents	D2240	D2240	D792	D297	D4894	D412	D4894/ D4745	D412
	("D" Scale)	("A" Scale)			D638 (PEEK)	D1414	D638 (PEEK)	D1414

Seal Type	Table 2 Performance Properties									
	Fluid Compatibility		Heat Resistance		Water Absorption		Compression Set		Abrasion Resistance	
	Plastic	Rubber	Plastic	Rubber	Plastic	Rubber	Plastic	Rubber	Plastic	Rubber
Pneumatic	O	O	X	X	O	N/A	X	X	Note	X
Hydraulic	X	X	X	X	O	N/A	X	X	O	O
Environmental	O	O	X	X	O	N/A	X	X	O	O
Insulating	O	O	X	X	O	N/A	X	X	Note	X
Dampening	O	O	O	O	O	N/A	X	X	O	O
Anti-Extrusion	X	X	O	O	O	N/A	X	X	Note	X
ASTM TEST METHOD										
Applicable Document	D543	D471	D3045	D573	D570	D412	D695	D395	Note	D2228
			D5510			D1414				

Note: determined by Manufacturer (repeatability must be demonstrated)

X = Required Test
O = Optional Test

Tables 1 and 2 above define the minimum performance standards for qualifying and documenting the performance of aircraft seals.

- 1. SEAL PROPERTIES.** The tables specify seal property test requirements for each seal type, as defined on the manufacturers' drawing(s) and/or specification(s). The specific material, meeting the material test property requirements, and specific design property values for dimensions/configuration form the basis of the seal's design. The performance property values for fluid compatibility, heat resistance, and abrasion resistance form the basis of the seal's "minimum performance."
- 2. SEAL SERIES TEST SAMPLE.** A seal series (model) of a particular design and type, with a range defined in the seal manufacturer's application for ITSOA, may be qualified by submitting test data for a sample that is most representative of the design encompassed by the series.
- 3. APPLICABLE ASTM TEST METHODS.** The revision of the documents listed below in effect on the date of ITSO application is considered acceptable to DGCA and used to establish the procedures for test and evaluation of aircraft seals as indicated in the part drawing and procurement or product specification(s). All additional specifications governing test and evaluation of a seal covered by this ITSO must be specified at the time of application for ITSOA.

D297 Test Methods for Rubber Products - Chemical Analysis

D395 Test Method for Rubber Property - Compression Set

D412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension

D471 Test Method for Rubber Property - Effect of Liquids

D543 Test Methods for Resistance of Plastics to Chemical Reagents

D570 Test Method for Water Absorption of Plastics.

D573 Test Method for Rubber - Deterioration in an Air Oven

D638 Test Method for Tensile Properties of Plastics

D695 Test Method for Compressive Properties of Rigid Plastics

D792 Test Method for Specific Gravity and Density of Plastics by Displacement

D1414 Test Methods for Rubber O-Rings

D2228 Test Method for Rubber Property - Abrasion Resistance (Pico Abrader)

D2240 Test Method for Rubber Property - Durometer Hardness

D3045 Practice for Heat Aging Plastics without Load

D4745 Specification for Filled Compounds of Polytetrafluorethylene (PTFE) Molding and Extrusion Materials

D4894 Specification for Polytetrafluorethylene (PTFE) Granular Molding and Ram Extrusion Materials

D5510 Practice for Heat Aging of Oxidatively Degradable Plastics