



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

TSO-C150a

Effective
Date: 10/26/11

Technical Standard Order

Subject: *TSO-C150a, Aircraft Seals*

1. **PURPOSE.** This technical standard order (TSO) is for manufacturers applying for a TSO authorization (TSOA) or letter of design approval (LODA). In it, we (the Federal Aviation Administration, (FAA)) tell you what minimum performance standards (MPS) your aircraft seals must first meet for approval and identification with the applicable TSO marking.

2. **APPLICABILITY.** This TSO affects new applications submitted after its effective date.

a. All prior revisions to this TSO are no longer effective. Generally, we will not accept applications for the previous revision after the effective date of this TSO. We may do so, however, up to six months after it, if we know that you were working against the prior MPS before the new change became effective.

b. *Aircraft seals* approved under a previous TSOA may still be manufactured under the provisions of its original approval.

3. **REQUIREMENTS.** New models of *aircraft seals* identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation test requirements in appendix 1, Aircraft Seal Property Test Requirements.

a. **Functionality.** This TSO's standards apply to seals for static and dynamic aircraft applications in pneumatic, hydraulic, environmental, insulating, dampening, and anti-extrusion systems. The TSO may be used to qualify a manufacturer's catalog seals, seals of proprietary designs, and for seals used in the manufacture and maintenance of aircraft products.

b. **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 article maintains an equivalent level of safety. Apply for a deviation under the provision of 14 CFR § 21.618.

4. **MARKING.**

a. Mark each article permanently and legibly with all the information in 14 CFR § 45.15(b). The marking for each package/container must include name or symbol of manufacturer, part number, TSO number, the expected shelf life and manufacturer's inspection lot number.

Note: When a seal is too small or otherwise impractical to mark with any of the information required by 14 CFR § 45.15(b), the TSOA or LODA holder must attach that information to the part or its container.

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

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

c. If the article includes a deviation per paragraph **3.b** of this TSO, the marking should include a means to indicate a deviation was granted.

5. APPLICATION DATA REQUIREMENTS. You must give the FAA aircraft certification office (ACO) manager responsible for your facility a statement of conformance, as specified in 14 CFR § 21.603(a)(1) and one copy each of the following technical data to support your design and production approval. LODA applicants must submit the same data through their civil aviation authority.

a. A manual(s) containing the following:

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

(2) A description in detail of any deviations

(3) Installation procedures and limitations sufficient to ensure that the aircraft seals, when installed according to the installation procedures, still meets this TSO'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 a technical standard order (TSO). Installation of this article requires separate approval."

b. Instructions covering periodic maintenance and repair, for the continued airworthiness of *aircraft seals*. Include recommended inspection intervals and service life, as appropriate.

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

d. Identify functionality, features or performance contained in the article not evaluated under paragraph **3** of this TSO (that is, non-TSO functions). Non-TSO functions are accepted in parallel with the TSO authorization. For those non-TSO functions to be accepted, you must declare these functions and include the following information with your TSO application:

(1) Description of the non-TSO function(s), such as performance specifications and software, hardware, and environmental qualification levels. Include a statement confirming that the non-TSO function(s) don't interfere with the article's compliance with the requirements of paragraph 3.

(2) Installation procedures and limitations sufficient to ensure that the non-TSO 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-TSO 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 TSO article is not affected by the non-TSO function(s).

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

e. The quality system description required by 14 CFR § 21.608, including functional test specifications. The quality system should ensure that you will detect any change to the approved design that could adversely affect compliance with the TSO MPS, and reject the article accordingly. (Not required for LODA applicants.)

f. Material and process specifications list.

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

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

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

b. Dimensional drawings.

c. Material and process specifications.

7. FURNISHED DATA REQUIREMENTS.

a. If furnishing one or more articles manufactured under this TSO to one entity (such as an operator or repair station), provide one copy or on-line access to the data in paragraphs **5.a through 5.b** of this TSO. Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the *aircraft seals*.

b. If the article contains declared non-TSO function(s), include one copy of the data in paragraphs **5.d.(1)** through **5.d.(4)**.

8. HOW TO GET REFERENCED DOCUMENTS

a. American Society for Testing and Materials (ASTM) documents may be purchased from: ASTM, 100 Barr harbor Drive, West Conshohocken, PA 19428-2959. You can also order copies online at www.astm.org.

b. Order copies of 14 CFR part 21, Subpart O from the Superintendent of Documents, Government Printing Office, P.O. Box 979050, St. Louis, MO 63197. Telephone (202) 512-1800, fax (202) 512-2250. You can also order copies online at www.access.gpo.gov. Select “Access”, then “Online Bookstore.” Select “Aviation,” then “Code of Federal Regulations.”

c. You can find a current list of technical standard orders and advisory circulars on the FAA Internet website Regulatory and Guidance Library at <http://rgl.faa.gov/>. You will also find the TSO Index of Articles at the same site.

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APPENDIX 1. AIRCRAFT SEAL PROPERTY 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 ("D" Scale)	D2240 ("A" Scale)	D792	D297	D4894 D638(PEEK)	D412 D1414	D4894/D4745 D638(PEEK)	D412 D1414

Seal Type	Table 2 Performance Properties									
	Fluid Compatability		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 Documents	D543	D471	D3045 D5510	D573	D570	D412 D1414	D695	D395	Note	D2228

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 TSOA or LODA, 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 TSO application is considered acceptable to the Administrator 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 TSO must be specified at the time of application for TSOA or LODA.

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