



Technical Standard Order

Subject: TSO-C148, AIRCRAFT MECHANICAL FASTENERS

1. PURPOSE. This technical standard order (TSO) prescribes the minimum performance standards that aircraft mechanical fasteners must meet to be identified with the applicable TSO marking.

2. APPLICABILITY. The standards of this TSO apply to specialized types of mechanical fasteners described in Appendix 1, Aircraft Mechanical Fastener Property Test Requirements, intended for tension and/or shear applications in the manufacture and maintenance of aircraft products. The standards are also adaptable to fasteners of proprietary designs. This TSO shall not be used for standard parts.

3. REQUIREMENTS. Aircraft mechanical fasteners that are to be identified with this TSO and that are manufactured on or after the date of this TSO must meet the minimum performance standards specified in the applicant's part drawing and applicable part specification(s) submitted with the fastener manufacturer's application for TSO authorization.

a. Test Requirements. The required performance shall be demonstrated by accomplishing the tests specified for each property in the part drawing and applicable part specification(s) in accordance with the test procedures specified in Appendix 1.

b. Deviations. Alternative test procedures that produce an equivalent level of safety may be used if specified at the time of TSO application and approved in accordance with 14 CFR §21.609.

4. MARKING.

a. In addition to the marking specified in 14 CFR §21.607(d), the fastener type and the manufacturer's inspection lot number shall be permanently and legibly marked on each package or container.

b. Each individual fastener that is manufactured under this TSO must be permanently and legibly marked with at least the name or symbol of the manufacturer and part identification. When this is not practical, marking may be accomplished in a manner acceptable to the Administrator.

5. DATA REQUIREMENTS.

a. In accordance with 14 CFR §21.605(a), the following data must be furnished to the Aircraft Certification Office (ACO) manager having purview of the manufacturer's facility with each TSO application:

- (1) Part drawing and applicable part specification(s) necessary to define the design, minimum performance, and metallurgy for each fastener part number.
- (2) Manufacturer's TSO qualification test report in accordance with the test procedures specified in Appendix 1.
- (3) Inspection lot number(s) of qualification parts.
- (4) Raw material heat (lot) or certification number for each qualification lot(s) of fasteners.

b. In Addition to the data required by paragraph 5.a., the following data must be available for review by the ACO manager having purview of the manufacturer's facility:

- (1) Copies of all standards/specifications used for substantiating the manufacturer's application for TSO authorization.
- (2) Inspection lot number and quantity for each production lot of fasteners.
- (3) Raw material heat (lot) or certification number for each production lot of fasteners.
- (4) Acceptance test results for each lot of fasteners.

c. Data and information that must accompany aircraft fasteners manufactured under this TSO:

- (1) Inspection lot number(s) and quantity of parts shipped.
- (2) A note with the following statement: "The parts contained in this shipment have been manufactured and inspected in accordance with TSO-C148. The conditions and tests required for TSO approval of this article are minimum performance standards. Aircraft fasteners approved under this TSO are not necessarily interchangeable with other aircraft fasteners approved under this TSO. Fasteners of similar dimensional properties may have widely varying performance and metallurgical properties. Substitution of parts may only be done if acceptable to or approved by the Administrator."

6. INSPECTION LOT OF FASTENERS. An inspection lot consists of a quantity of fasteners with one part number produced consecutively from a single mill heat of material, heat treated and finished in one continuous process or single batch, and subsequently submitted for final inspection at one time.

7. AVAILABILITY OF REFERENCE DOCUMENTS.

- a. American Society for Testing and Materials (ASTM) documents may be purchased from: ASTM, 100 Barr Harbor Drive, West Conshohocken PA 19428-2959.
- b. Military documents may be purchased from: DoDSSP, Customer Service Subscription Service Desk, 700 Robins Avenue, Building 4D, Philadelphia, PA 19111-5094.
- c. American Society of Mechanical Engineers (ASME) documents may be purchased from: ASME, 345 East 47th Street, New York, NY 10017.
- d. Federal Aviation Regulations Part 21, Subpart O, may be purchased from: Superintendent of Documents, Government Printing Office, Washington, DC 20402-9325.
- e. Advisory Circular 20-110 (current revision), "Index of Aviation Technical Standard Orders," may be obtained from: U.S. Department of Transportation, Subsequent Distribution Office, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785.

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APPENDIX 1

Aircraft Mechanical Fastener Property Test Requirements Table

Fastener Type	Design Properties			Performance Properties					Metallurgical Properties	
	Material	Dimensions	Heat Treat	Tensile	Shear	Torque	Fatigue	Preload	Metallurgy	Discontinuity
Bolts, Screws, Studs	X	X	X	X	X		X		X	X
Structural Nuts	X	X	X	X		X			X	X
Skin Fasteners, Threaded	X	X	X		X		X		X	X
Collars	X	X	X	X		X		X	X	X
Inserts and Washers	X	X	X					X	X	X
Skin Fasteners, Unthreaded	X	X	X	X	X		X	X	X	X
Rivets, Pins	X	X	X		X				X	X
Blind Fasteners	X	X	X	X	X				X	X
Captive Screws & Panel Fasteners	X	X	X	X	X				X	X
Sandwich Panel Fasteners, Threaded	X	X	X	X		X			X	X
Sandwich Panel Fasteners, Unthreaded	X	X	X						X	X
Applicable Test Documents	Part Drawing	Part Drawing ASME B1.3M System 22 (for screw threads only)	MIL-H-6088 MIL-H-6875 MIL-H-81200	MIL-STD-1312	MIL-STD-1312	MIL-STD-1312	MIL-STD-1312	MIL-STD-1312	ASTM E 3 ASTM E 140	ASTM E 1417 ASTM E 1444

AIRCRAFT MECHANICAL FASTENER PROPERTY TEST REQUIREMENTS

1. FASTENER PROPERTIES. The Table specifies fastener property test requirements for each fastener type, as defined on the manufacturers drawing(s) and/or specification(s). The specific material, dimension(s), and heat treat form the basis of the fastener's design; the specific values for tensile, shear, torque, fatigue, and preload form the basis of the fastener's "minimum performance;" and metallurgy and discontinuity are the fastener's metallurgical properties.

2. FASTENER SERIES TEST SAMPLE. A fastener series (model) of a particular design, metallurgy, and type, with a range defined in the fastener manufacturers application for TSO authorization, may be qualified by submitting test data for a sample that is most representative of the design and metallurgy encompassed by the series.

APPENDIX 1 - continued

3. APPLICABLE DOCUMENTS. The revision of the documents (or successor documents) listed below in effect on the date of TSO application must be acceptable to the administrator and used to establish the procedures for test and evaluation of aircraft fasteners as indicated in the part drawing and procurement or product specification. All additional specifications governing test and evaluation of a fastener covered by this TSO must be specified at the time of application for TSO authorization.

ASTM E 3	Preparation of Metallographic Specimens
ASTM E 140	Standard Hardness Conversion Tables for Metals
ASTM E 1417	Standard Practice for Liquid Penetrant Examination
ASTM E 1444	Standard Practice for Magnetic Particle Examination
ASME B1.3M	Screw Thread Gaging Systems For Dimensional Acceptability, System 22
MIL-H-6088	Heat Treatment, Aluminum Alloys
MIL-H-6875	Heat Treatment of Steel, Process for
MIL-H-81200	Heat Treatment of Titanium and Titanium Alloys, Process for
MIL-STD-1312	Fastener Test Methods