



AEROSPACE RECOMMENDED PRACTICE

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

ARP 618

Issued January 1975
Revised

BOSS FITTINGS, METAL SEAL, FLUID SYSTEMS; GENERAL REQUIREMENTS FOR

1. SCOPE

- 1.1 Scope: This ARP establishes the basic test and design requirements for separable metal seal boss fittings for use in aerospace fluid systems.
- 1.2 Purpose: This document recommends the design criteria, installation, and test requirements for boss fittings utilizing integral metal seals.
- 1.3 Classification: Boss fittings covered by this specification shall be of the following types and classes:

Type	Temperature Range
I	-65° F to +160° F (-55° + 70° C)
II	-65° F to +275° F (-55° +135° C)
III	-65° F to +450° F (-55° +235° C)
IV	-65° F to +600° F (-55° +320° C)

Class	
1500 psi (103 Bars)	Where the cutout pressure at the main pressure controlling device is 1500 psig $\pm$ 15%
3000 psi (207 Bars)	Where the cutout pressure at the main pressure controlling device is 3000 psig $\pm$ 15%
4000 psi (276 Bars)	Where the cutout pressure at the main pressure controlling device is 4000 psig $\pm$ 15%

2. APPLICABLE DOCUMENTS

- 2.1 The following is a list of specifications pertaining to this ARP:

2.1.1 Military Specifications and Standards:

MIL-S-5002	Surface Treatments and Metallic Coating for Metal Surfaces of Weapons Systems
MIL-H-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
MIL-T-6845	Tubing; Steel, Corrosion-Resisting (304) Aerospace Vehicle Hydraulic System, 1/8 Hard Condition
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-794	Parts and Equipment, Procedures for Packaging and Packing of

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

2.1.2 Other Publications:

Society of Automotive Engineers (SAE)

- ARP 899 Tube Fittings, Fluid Systems, Permanent Type; General Requirements for
- AMS 2552 Cleaning, Packaging, and Assembly of Critical System Components Clean
Room Procedure, 500 micron max. particle size.
- AMS 2553 Cleaning, Packaging, and Assembly of Critical System Components Clean
Area Procedure, 2500 micron max. particle size.

American National Standards Institute, Inc.

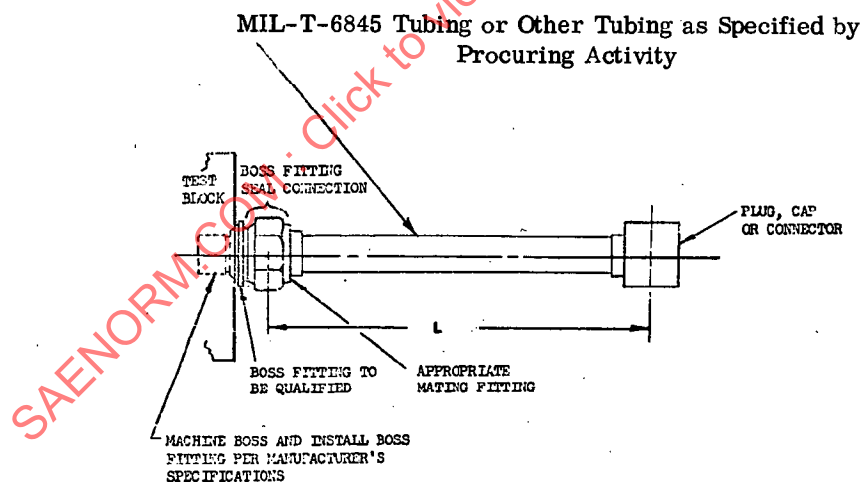
- ANSI B46.1 Surface Texture (Surface Roughness, Waviness and Lay)

3. REQUIREMENTS

- 3.1 Qualification Tests: Boss fittings furnished under this document shall be considered qualified if they are identical to those that have been tested and have passed the qualification tests defined herein. They shall be considered suitable for use in aerospace fluid systems under conditions specified herein.
- 3.2 Materials:
- 3.2.1 Fittings: Boss fittings shall be manufactured from materials as specified or approved for the individual design, and suitable for and compatible with the specified system tubing, port material, fluid temperature, fluid and pressure. The materials shall be uniform in quality and free from defects.
- 3.2.2 Tubing: The tubing used for the fabrication of the test assemblies shall be uniform in quality and free from defects, and of a material and heat treatment or work-hardened condition as specified or approved by the procuring activity. The tubing wall thickness and tolerances shall permit the test assemblies to meet the requirements of this specification. Tubing material, finish and dimensional tolerances shall be as specified or approved by the procuring activity.
- 3.3 Design and Dimension: Boss fittings shall be so designed that tooling and processing to accomplish their installation will require a minimum amount of space (reference 3.3.4). All pertinent dimensions and tolerances, where interchangeability, operation, or performance of the assembled boss fitting may be affected, shall be specified on the drawing.
- 3.3.1 Drill Offset: On boss fittings where the fluid passage is drilled from each end, the offset between the drilled holes at the meeting point of the drills shall not exceed 0.005 in. (0.127 mm). Angular misalignment between drilled holes shall not exceed 2 degrees (0.0349 rad.).
- 3.3.2 Reduction in Fluid Passage Cross Section: It shall be possible to pass through the passage a ball whose diameter is 0.010 in. (0.254 mm) less than the minimum diameter specified for the passage.
- 3.3.3 Weight: Boss fitting weight shall be held to a minimum. Actual nominal weights shall be shown on the manufacturer's drawings.
- 3.3.4 Installation Tooling: Tool envelopes, including joint alignment and joint process tooling required to install boss fittings in a vehicle and to effect repair or replacement of the boss fittings within the system, shall be kept to a minimum. Where possible, standard wrenches or tools shall be employed.
- 3.3.5 Material Certification: Records of Chemical composition analysis and mechanical property tests showing conformance to applicable specifications shall be made available to the procuring activity for each lot of boss fittings (see 6.3.4).

- 3.4 **Surface Treatment:** Unless otherwise specified, surface treatment of corrosion-resistant steel boss fittings shall be in accordance with Specification MIL-S-5002. After installation and attachment to the tubing, the boss fitting, including the fitting-tube junction (6.3.5), shall retain their corrosion resistance when subjected to the stress corrosion tests per 4.7.3.
- 3.5 **Identification of Product:** All boss fittings shall be identified in accordance with the following instructions. Marking shall be impressed, embossed, electroetched, or plated without damage to the boss fitting. All marking shall remain legible after the boss fitting is permanently joined to the tubing. Boss fittings too small, or without suitable noncritical surfaces, shall be identified by markings on the package or a tag within the package.
- 3.5.1 **Symbol and Trademark:** Unless otherwise specified, all boss fittings shall be marked with the manufacturer's identification or trademark.
- 3.5.2 **Part Number:** Unless otherwise specified, boss fittings shall be marked with the manufacturer's basic part number.
- 3.6 **Performance:** Boss fittings, when installed in an appropriate port and attached to a length of tubing with an appropriate mating fitting (Fig. 1), shall satisfy the performance requirements for proof pressure, burst pressure, thermal shock, impulse, flexure, gaseous leak, and stress corrosion tests as specified in the performance requirements section of ARP 899, and those tests specified in the following subparagraphs. In addition to the failure criterion specified by ARP 899, failure shall include leakage at the boss to test block interface.

Note: Adverse tolerance conditions shall be evaluated by analytical means. At the option of the user, verification torque tests may be required to the values specified for maximum and minimum tightening (4.7.4).



BOSS FITTING TEST SAMPLE CONFIGURATION

FIGURE 1

- NOTES: 1. At least 50% of the samples will be torqued to the minimum torque and the balance to the maximum torque. Torque values to be supplied by the manufacturer.
2. No additional lubricant beyond that supplied by the manufacturer shall be applied to the boss fitting seal connections.

- 3.6.1 Repeated Assembly: The test assembly shall withstand 25 repeated assemblies, at the manufacturer's recommended minimum and maximum torque values, without failure when tested in accordance with 4.7.4.
- Failure criterion shall be:
- A. Leakage at any of the proof pressure tests.
 - B. Leakage or burst at a value less than four times the nominal operating pressure during the burst pressure testing.
 - C. Inability to assemble the fitting to the point of interface by hand.
 - D. Nut deformation preventing engagement of nut hex with open end wrench.
- 3.6.2 Adverse Conditions: Adverse conditions (i.e., dimensional tolerances, material hardness, finish, etc.) shall be evaluated by test or analytical means.
- 3.6.3 Contamination: The test assemblies shall meet the contamination test requirements of 4.7.5.
- 3.7 Cleanliness: Cleanliness of the fitting is essential to ensure proper performance. Care shall be used in the manufacture, handling, assembly, testing and packaging of the boss fittings to ensure cleanliness. The final cleanliness level shall be per AMS 2552 or AMS 2553, or other cleaning specification approved by the procuring activity. Assembly, acceptance testing, flushing, sealing and packaging shall be done in an area sufficiently clean to ensure that the capability of the fitting shall not be impaired.
- 3.8 Workmanship: Boss fittings shall comply with the workmanship and marking requirements of this document when examined in accordance with 4.7.2. Machined surfaces of fittings shall be free from burrs, slivers and particles that can dislodge and become entrapped within the fitting before or during usage. Machined surface finish shall not exceed 125 RHR (3.175 μm). Unmachined surfaces, such as forging surfaces and bar stock flats, shall be of uniform quality and condition, free from blisters, fins, folds, seams, laps, cracks, segregations, spongy areas, or other defects which would adversely affect their serviceability, and except for forging parting lines, shall not exceed 250 RHR (6.350 μm) as defined by ANSI B46.1.
4. QUALITY ASSURANCE PROVISIONS
- 4.1 Responsibility for Inspection: Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the manufacturer may utilize his own facility or any commercial laboratory acceptable to the procuring activity. The procuring activity reserves the right to perform any inspection set forth in the specification whenever such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.
- 4.2 Material Certification: Records of the chemical analysis and mechanical property tests showing conformance to the applicable specification shall be made available to the procuring activity upon request. Material, heat treat and inspection records shall be retained for a period of five years.
- 4.3 Classification of Tests:
- A. Qualification Tests (4.4) (6.3.6)
 - B. Quality Conformance Tests (4.5) (6.3.7)
 - C. First Article Inspection Tests (4.5) (6.3.8)

4.4 Qualification Tests:

4.4.1 Sampling Instructions: Test samples shall consist of the test assemblies specified in Table I for each size and type of boss fitting for which approval is desired.

TABLE I
TEST SAMPLES AND SEQUENCE OF TESTING

Assembly Numbers L (see Figure 1)	1 - 4 6" (152.4 mm)	5 - 7 6"	8 - 9 6"	10 - 17 per Table I ARP 1185	18 - 23 6"
Test Sequence	4.4.2a	4.4.2a	4.4.2a	4.4.2a	4.4.2a
	4.4.2b	4.4.2g	4.4.2g	4.4.2b	4.4.2b
	4.4.2h	4.4.2b	4.4.2b	4.4.2f	4.4.2j
	4.4.2e	4.4.2c	4.4.2d		

NOTES:

1. It is permissible to run each test on separate samples in the quantities indicated when specified or approved by the procuring activity.
2. It is also permissible to combine certain tests in order to minimize sample quantities when approved by the procuring activity.
3. It is also permissible to combine boss fitting tests with permanent or separable fitting tests when approved by the procuring activity.

4.4.2 Tests: The qualification tests shall consist of the following requirements and tests, as applicable, and as specified in sections 3 and 4.

- A. Examination of Product (3.8, 4.7.2)
- B. Proof Pressure (3.6, 4.7.3)
- C. Burst Pressure (3.6, 4.7.3)
- D. Thermal Shock (3.6, 4.7.3)
- E. Impulse (3.6, 4.7.3)
- F. Flexure (3.6, 4.7.3)
- G. Gaseous Leak (3.6, 4.7.3)
- H. Stress Corrosion (3.6, 4.7.3)
- J. Repeated Assembly (3.6.1, 4.7.4)
- K. Adverse Conditions (3.6.2, 4.4.3)

4.4.3 Additional Testing: Additional testing to evaluate adverse conditions (i.e., dimensional tolerances, material hardness, finish, etc.), as deemed necessary, shall be specified and approved by the procuring activity.

4.5 Quality Conformance and First Article Inspection Tests: Shall be specified at the option of the procuring agency.