



METRIC AEROSPACE STANDARD

MA2005™**REV. C**

Issued 1981-09
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Revised 2021-06

Superseding MA2005B

Tube Fittings, Aerospace Fluid Systems, Separable,
for 24 Degree Cone, General Specification, Metric (ISO 7169)

RATIONALE

Quality conformance inspection requirements revised to correct AQL levels in 4.2.2.1.2. Replace tubing specification MA2016 with ISO 8575 in 3.2.2.

FOREWORD

This document is equivalent to ISO 7169 with the exception that U.S. materials, test, and process specifications are used where ISO standards are not available. The ISO 7169 is based on MIL-F-18280.

This document establishes the basic performance and quality criteria for screw-together tube fitting assemblies and port connectors used in aerospace fluid systems.

The performance test requirements are intended to satisfy the most strenuous demands encountered in high-performance aircraft hydraulic systems. The procurement requirements are intended to ensure that fittings, which are procured in accordance with this specification, are of the same quality as the fittings used during the original qualification testing. Compliance with these test and procurement requirements is necessary for fittings that are used in control systems where a malfunction would affect the safety of flight.

1. SCOPE

This document specifies performance and quality requirements for the qualification and manufacture of 24 degree cone fittings to ensure reliable performance in aircraft hydraulic systems.

This document specifies baseline criteria for the design and manufacture of system fittings that are qualification tested on engines.

This document covers fittings of temperature types and pressure classes specified in MA2001.

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2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2486	Conversion Coating of Titanium Alloys, Fluoride-Phosphate Type
AMS2488	Anodic Treatment - Titanium and Titanium Alloys, Solution pH 13 or Higher
AMS4928	Titanium Alloy Bars, Wire, Forgings, Rings, and Drawn Shapes, 6Al - 4V, Annealed
AMS4945	Titanium Alloy Tubing, Seamless, Hydraulic, 3Al - 2.5V, Controlled Contractile Strain Ratio, Cold Worked, Stress Relieved
AMS4952	Titanium Alloy, Welding Wire, 6Al - 2Sn - 4Zr - 2Mo
AMS4945	Titanium Alloy Tubing, Seamless, Hydraulic, 3Al - 2.5V, Controlled Contractile Strain Ratio, Cold Worked, Stress Relieved
AMS5561	Steel, Corrosion and Heat-Resistant, Welded and Drawn or Seamless and Drawn Tubing, 9.0Mn - 20Cr - 6.5Ni - 0.28N, High-Pressure Hydraulic
AMS5658	Steel Bars, Forgings, and Rings, Corrosion Resistant, 15Cr - 4.5Ni - 0.30 (Cb + Ta) - 3.5Cu
AMS5659	Steel, Corrosion-Resistant, Bars, Wire, Forgings, Rings, and Extrusions, 15Cr - 4.5Ni - 0.30Cb (Nb) - 3.5Cu
AS1055	Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components
MA2001	Aerospace Fluid Systems and Components - Pressure and Temperature Classifications
MA2094	Test Methods for Tube-Fitting Assemblies, Metric (ISO 10583)

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A108	Steel Bars, Carbon, Cold Finished, Standard Quality, Specification for
ASTM E1444	Heat Treatment of Aluminum Alloys

2.1.3 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloy
MIL-F-18280	Fittings, Flareless Tube, Fluid Connection
MIL-I-6868	Inspection Process, Magnetic Particle
MIL-S-5002	Surface Treatment and Metallic Coatings for Metal Surfaces of Weapon Systems
MIL-S-6758	Steel, Chrome-Molybdenum (4130) Bars and Reforging Stock (Aircraft Quality)
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes (ISO 2859)
MIL-STD-810	Environmental Test Methods
MIL-T-6845	Tubing, Steel, Corrosion Resistant (304) Aerospace Hydraulic Systems, 1/8 Hard Condition
MIL-T-7081	Tube, Aluminum Alloy, Seamless, Round, Drawn, Aircraft Hydraulic Quality
MIL-T-9046	Titanium and Titanium Alloy Sheet, Strip, and Plate
QQ-A-225/6	Aluminum Alloy Bar, Rod and Wire; Rolled, Drawn or Cold Finished, 2024
QQ-A-225/9	Aluminum Alloy Bar, Rod, Wire and Special Shapes, Rolled, Drawn or Cold Finished, 7075
QQ-A-367	Aluminum Alloy, Forgings, Heat Treated
QQ-P-35	Passivation Treatment for Corrosion Resistant Steels
QQ-P-416	Plating, Cadmium, Electrodeposited
QQ-S-637	Steel Bar, Carbon, Cold Finished (Standard Quality, Free Machining)
QQ-S-763	Steel Bars, Shapes, and Forgings, Corrosion Resistant (304)
QQ-S-763	Steel Bars, Shapes, and Forgings, Corrosion Resistant (347)
QQ-S-763	Steel Bars, Shapes, and Forgings, Corrosion Resistant (316)

2.1.4 ANSI Accredited Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

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

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 ISO Publications

Available from International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, Tel: +41 22 749 01 11, www.iso.org.

ISO 468:1982	Surface Roughness - Parameters, Their Values and General Rules For Specifying Requirements
ISO 2685:1992	Aircraft - Environmental Conditions and Test Procedures for Airborne Equipment - Resistance to Fire in Designated Fire Zones
ISO 2859-1:1989	Sampling Procedures for Inspection by Attributes - Part 1: Sampling Plans Indexed by Acceptable Quality Level (AQL) for Lot-by-Lot Inspection
ISO 6771:1987	Aerospace - Fluid Systems and Components - Pressure and Temperature Classifications
ISO 6772:1988	Aerospace - Fluid Systems - Impulse Testing of Hydraulic Hose, Tubing and Fitting Assemblies
ISO 7257:1983	Aircraft - Hydraulic Tubing Joints and Fittings - Rotary Flexure Test
ISO 8575:1990	Aerospace - Fluid Systems - Hydraulic System Tubing
ISO 9538	Aerospace - Hydraulic Tubing Joints and Fittings - Planar Flexure Test
ISO 10583:1993	Aerospace Fluid Systems - Test Methods for Tube/Fitting Assemblies

2.3 Definitions

For the purposes of this document, the following definitions apply.

2.3.1 Workmanship and Surface Defects

2.3.1.1 SURFACE IRREGULARITY

Nonconformity with general surface appearance, possible defect.

2.3.1.2 CRACK

Clean (crystalline) fracture passing through or across the grain boundaries that possibly follows inclusions of foreign elements. Cracks are normally caused by overstressing the metal during forging or other forming operations, or during heat treatment. Where parts are subject to significant reheating, cracks are usually discolored by scale.

2.3.1.3 FOLD

Doubling over of metal, which can occur during the forging operation. Folds can occur at or near the intersection of diameter changes and are especially prevalent with noncircular necks, shoulders, and heads.

2.3.1.4 LAP

Fold-like machining defect.

2.3.1.5 SEAM

- a. Usually a surface opening or crack resulting from a defect obtained during casting or forging.
- b. Extraneous material, stringer in the material, which is not homogeneous with base metal.

2.3.1.6 PIT

Void or hole in the surface as caused, for example, by corrosion.

2.3.1.7 LEAKAGE

- a. Wetting or formation of a drop or drops of test fluid in pressure testing or of a bubble in pneumatic testing.
- b. Spillage of test fluid due to rupture.

2.3.2 Fitting Components

Fitting components are designated as illustrated in Figure 1.

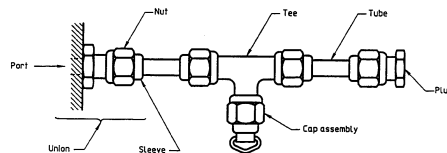


Figure 1 - Fitting assembly part designations

2.3.3 Quality Assurance

2.3.3.1 LOT

Manufacturer's run of a given part number from the same batch of material, processed at the same time and in the same manner.

2.3.3.2 QUALIFICATION TEST

Performance testing required to demonstrate successful performance of the fitting in simulated service, using overload, destructive, and accelerated tests.

3. REQUIREMENTS

3.1 Qualification

Fittings claiming conformity with this document shall be representative of products which have successfully met the requirements and have passed the tests specified in this document.

3.2 Materials

3.2.1 Fittings

The fitting parts shall be manufactured from materials as given in Table 1 or equivalents passing the specified qualification tests. The various materials shall be used according to the pressure and temperature requirements of the system (see Table 1).

3.2.2 Tubing

The tubing used with the fittings shall be in accordance with ISO 8575 or equivalent tubing passing the specified qualification tests.

3.3 Design and Manufacture

3.3.1 Threads

Threads may be cut, rolled, or—except for titanium—ground. The external threads of fittings should be rolled and, if machined, shall have a roughness average, R_a , of 3.2 μm or smoother.

3.3.1.1 Rolled Threads

Laps, cracks, surface irregularities, and seams (see 2.4.2.5) are not acceptable on any part the pressure thread flank, in the threadroot or on the nonpressure thread flank. Laps and seams, whose depths are within the limits of Table 2, are acceptable on the crest and the nonpressure thread flank above the pitch diameter.

3.3.2 Fluid Passages

On fittings where the fluid passage is drilled from each end, the offset between the drilled holes at the meeting point shall not exceed 0.4 mm. It shall be possible to pass through the fitting passage a ball whose diameter is 0.5 mm less than the minimum diameter specified for the passage.

3.4 Surface Protection and Color Identification

3.4.1 Surface Protection

The surfaces of fitting parts shall be protected in the following manner:

- a. Aluminum alloy fittings: By sulfuric acid anodizing, then dyeing and dichromate or nickel acetate sealing per MIL-A-8625 Type II, Class 2.
- b. Carbon steel fittings and sleeves: By cadmium plating 0.007 to 0.012 mm thick, followed by a chromate postplate treatment per QQ-P-416.
- c. Corrosion-resistant steel fittings: By passivation treatment per QQ-P-35 Type IV or VII for 300 series CRES and Type II or VIII for 17-4 PH and 15-5 PH CRES. Sleeves may be cadmium plated.
- d. Titanium fittings: By a fluoride conversion coating per AMS2486 or anodizing process per AMS2488.