



AEROSPACE STANDARD

AS4510™**REV. A**

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Revised 2019-03

Superseding AS4510

(R) Fittings, Weld, Fluid Connection, 5000 psi Maximum

RATIONALE

Qualification specifics for weld-to-beam seal reduced-wall/reduced-pressure fittings are not included in AS85421, AS85720, AS4510, or AS4510/2. This revision will clarify qualification requirements for those fitting versions. Additionally, dash codifications that are on current detail standards, but not in AS4510, are being added.

1. SCOPE

1.1 Scope

This SAE Aerospace Standard (AS) establishes the requirements for weld fluid connection fittings and rings to be orbital arc welded to tubing for use in aircraft fluid systems up to a maximum operating pressure of 5000 psi.

1.2 Classification

Fittings and rings shall be furnished in the types and styles designated by the applicable AS or other engineering part standard drawings. This specification is intended to serve as a procurement specification for the fittings described herein. The requirements for weld to separable fittings are given in slash specifications such as AS4510/1 and AS4510/2.

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.

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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.

AMS2759	Heat Treatment of Steel Parts, General Requirements
AMS4928	Titanium Alloy Bars, Wire, Forgings, Rings, and Drawn Shapes, 6Al - 4V, Annealed
AMS4944	Titanium Alloy Tubing, Seamless, Hydraulic, 3.0Al - 2.5V, Cold Worked, Stress Relieved
AMS4945	Titanium Alloy Tubing, Seamless, Hydraulic, 3Al - 2.5V, Controlled Contractile Strain Ratio, Cold Worked, Stress Relieved
AMS4965	Titanium Alloy, Bars, Wire, Forgings, and Rings, 6.0Al - 4.0V, Solution Heat Treated and Aged
AMS5561	Steel, Corrosion and Heat-Resistant, Welded and Drawn or Seamless and Drawn Tubing, 9.0Mn - 20Cr - 6.5Ni - 0.28N, High-Pressure Hydraulic
AMS5659	Steel, Corrosion-Resistant, Bars, Wire, Forgings, Rings, and Extrusions, 15Cr - 4.5Ni - 0.30Cb (Nb) - 3.5 Cu
AMS6349	Steel Bars, 0.95Cr - 0.20Mo (0.38 to 0.43C) (SAE 4140), Normalized
AMS6382	Steel, Bars, Forgings, and Rings, 0.95Cr - 0.20Mo (0.38 - 0.43C) (SAE 4140), Annealed
AMS-H-6875	Heat Treatment of Steel Raw Materials
ARP603	Impulse Testing of Hydraulic Hose, Tubing, and Fitting Assemblies
ARP1185	Flexure Testing of Hydraulic Tubing Joints and Fittings
ARP4784	Definitions and Limits, Metal Material Defects and Surface and Edge Features, Fluid Couplings, Fittings and Hose Ends
AS478	Identification Marking Methods
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft
AS1376	Alternate Dimensions, Center Body Section, Shape Fluid Fitting, Design Standard
AS1579	Fitting End, Integral Weld, Lip, Design Standard
AS4510/1	Fittings, Weld to 24° Cone Flareless, Fluid Connection
AS4510/2	Fittings, Weld to Beam Seal, Fluid Connection
AS4697	Fitting End, Integral Centered Weld Lip, Design Standard

2.1.2 U.S. Government Publications

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

MIL-PRF-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance
MIL-PRF-6083	Hydraulic Fluid, Petroleum Base, For Preservation and Operation
MIL-PRF-46170	Hydraulic Fluid, Rust Inhibited, Fire Resistant Synthetic Hydrocarbon Base
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, Nato Code Number H-537
MIL-STD-129	Marking for Shipment and Storage

2.1.3 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)
ANSI/ASQ Z1.4	Sampling Procedures and Tables for Inspection by Attributes
ANSI Z540.1	Calibration Laboratories in Measuring Test Equipment, General Requirements
ASME Y14.38	Abbreviations and Acronyms for Use on Drawings and Related Documents

2.1.4 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 10012-1	Quality Assurance Requirements for Measuring Equipment
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2.2 Abbreviations and Acronyms

Standard abbreviations and acronyms used in this document and frequently used in aerospace technical documents may be found in ASME Y14.38.

2.3 Definitions

Definitions of terms used in this document and frequently used in aerospace technical documents are given in AIR4843.

3. TECHNICAL REQUIREMENTS

3.1 Material

Fittings and rings shall be fabricated of materials listed in Table 1 and in compliance with requirements in this specification or as specified on the applicable part standard drawing.

Table 1 - Materials

Material	Type of Part	Form	Specification	Alloy & Temper	Material Code
Corrosion resistant steel	Rings	Bars	AMS5656	Type 21-6-9	Z
	Straight and Shape Fittings	Bars	AMS5643	Type 17-4ph to condition H1075	P
	Straight and Shape Fittings	Bars	AMS5656	Type 15-5ph to condition H1075	V
	Shape fittings	Forgings	AMS5643	Type 17-4ph to condition H1075	P
	Shape fittings	Forgings	AMS5656	Type 15-5ph to condition H1075	V
Titanium alloy	Straight and Shape Fittings and Rings	Bars	AMS4928	6Al-4V annealed	A
	Straight and Shape Fittings and Rings	Bars	AMS4965	6Al-4V solution heat treated & aged	T
	Shape fittings	Forgings	AMS4928	6Al-4V annealed	A
	Shape fittings	Forgings	AMS4965	6Al-4V solution heat treated & aged	T

3.1.1 Heat Treatment

Unless otherwise specified on the applicable drawings, the type 15-5ph and 17-4ph corrosion resistant steel materials shall be heat treated to condition H-1075 per AMS2759/3, before or after machining.

3.2 Design and Fabrication

The design and fabrication of the fittings and rings shall be in accordance with the applicable drawings. The fitting ends shall be in accordance with AS1579 or AS4697, as applicable. Dimensional requirements are applicable after heat treatment and protective finishing. The center body section of shape fittings machined from bar or oversized forgings shall conform to AS1376.

3.2.1 Shape and Form Restrictions

Abrupt reductions of section shall be avoided. Small external sections adjoining relatively heavy body sections shall transition into the heavier sections by means of ample fillets.

3.2.2 Passages

3.2.2.1 Machining Offset

For straight fittings where the fluid passage is machined from each end, the offset between the machined holes at the meeting point of the holes shall not exceed 0.015 inch. It shall be possible to pass through the fluid passage a ball whose diameter is 0.020 less than the minimum diameter specified for the passage. This does not mean that the fluid passage may be smaller than that required by the detail standard part drawings.

3.2.2.2 Cross Section at Fluid Path Junction

For shape fittings, the cross-sectional area at the junction of fluid passages shall be such that it shall be possible to pass through the fitting from end to end, a ball whose diameter is not less than 0.7 times the minimum diameter specified for the smaller passage.

3.3 Finish

3.3.1 Corrosion Resistant Steel

Corrosion resistant steel fittings and rings have no finish, unless otherwise specified.

3.3.2 Titanium Alloy Rings and Fittings

Titanium alloy rings shall have no finish. Titanium alloy fittings shall have no finish on the weld end surfaces within a distance from the weld end of one half the nominal tube OD minimum.

3.4 Cleaning

Parts that are to be cleaned only to standard industry practice for fittings shall have no code letter after the part number and shall be cleaned per 5.1.1. These parts may then have special cleaning as specified by the user prior to welding. Parts that are to be alkaline cleaned as suitable for welding shall have the letter "C" after the part number and shall be cleaned per 5.1.3.

3.5 Identification of Product

All fittings and rings shall be marked in accordance with the following instructions. The marking shall be applied per AS478 as specified on the applicable drawing in a location not detrimental to the performance of the fitting and not detrimental to the corrosion protection of the fitting. When items cannot be physically marked because of lack of space or because marking would have a deleterious effect, the package shall provide the identification per 5.2.

3.5.1 Manufacturer's Identification

Unless otherwise specified, all fittings shall be marked with the manufacturer's name, CAGE code or trademark, and with the letters AS. Rings shall not be marked.

3.5.2 Material Identification

Fittings shall be marked with the material code letter as shown in Table 1. Forged shapes such as elbows or tees shall also be marked with the forging manufacturer's trademark or a code identification letter or number.

3.5.3 Marking for Part Number and Size

A numerical size code equivalent to the nominal tube size in 0.062 inch increments is optional. All fittings and sleeves larger than 06 fitting size code shall be marked with the basic part number, exclusive of size. Fitting assemblies with assembled nuts shall be marked as above on the fitting body, but assembled nuts that have their own part number identification are acceptable. Rings shall not be marked, but the package shall be identified per 5.2.

3.6 Performance

The fittings and rings, when assembled to tubing specified in Tables 2 or 3 and tested in accordance with applicable procedures specified in Section 4, shall meet the following performance requirements. Weld fittings with separable fitting ends shall have had their separable fitting connection tested per the applicable performance specification for that type of connection at the applicable operating pressure but the separable fitting connection shall not fail the performance requirements of this specification when tested at the applicable operating pressure.

Table 2 - Tubing wall thickness, operating pressure, and flexure test stress for weld fittings with type 21-6-9 corrosion resistant steel tubing

Nominal Tubing OD	Tube Size in 0.062 Increments	Nominal Wall Thickness Type 21-6-9 Corrosion Resistant Steel Tubing per AMS5561	Maximum Operating Pressure psi Corrosion Resistant Steel Fittings	Bending Stress Level in Tube for Flexure Test +0/-10% psi Corrosion Resistant Steel Fittings
0.188	03	0.016-0.018	3000	24000
0.188	03	0.019-0.022	4000	24000
0.188	03	0.019-0.022	5000	24000
0.250	04	0.016-0.018	3000	24000
0.250	04	0.019-0.022	4000	24000
0.250	04	0.019-0.022	5000	24000
0.312	05	0.019-0.022	3000	24000
0.312	05	0.019-0.022	4000	24000
0.312	05	0.024-0.028	5000	24000
0.375	06	0.019-0.022	3000	22000
0.375	06	0.023-0.028	4000	22000
0.375	06	0.029-0.032	5000	22000
0.500	08	0.023-0.028	3000	20000
0.500	08	0.019-0.022	2000	20000
0.500	08	0.033-0.043	4000	20000
0.500	08	0.038-0.043	5000	20000
0.625	10	0.023-0.028	2000	18000
0.625	10	0.033-0.043	3000	18000
0.625	10	0.038-0.043	4000	18000
0.625	10	0.044-0.055	5000	18000
0.750	12	0.023-0.028	2000	16000
0.750	12	0.035-0.043	3000	16000
0.750	12	0.044-0.055	4000	16000
0.750	12	0.056-0.065	5000	16000
0.875	14	0.029-0.032	2000	15000
0.875	14	0.056-0.065	3000	15000
1.000	16	0.033-0.043	2000	15000
1.000	16	0.046-0.055	3000	15000
1.000	16	0.061-0.065	3000	15000
1.000	16	0.066-0.078	4000	15000
1.000	16	0.075-0.078	5000	15000
1.250	20	0.030-0.032	1500	15000
1.250	20	0.039-0.043	2000	15000
1.250	20	0.044-0.055	2000	15000
1.250	20	0.058-0.065	3000	15000
1.250	20	0.079-0.089	3000	15000
1.250	20	0.076-0.078	4000	15000
1.500	24	0.036-0.043	1500	15000
1.500	24	0.044-0.055	2000	15000
1.500	24	0.069-0.078	3000	15000