



AEROSPACE STANDARD

AS4604™**REV. C**

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Superseding AS4604B

Hose Assembly, 3000 psi, Polytetrafluoroethylene, Metallic
Reinforced, 400 °F, Heavy Duty, Aircraft Hydraulic Systems

RATIONALE

This technical report is being stabilized because it covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

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**Documents**

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1. SCOPE:

This SAE Aerospace Standard (AS) defines the requirements for heavy-duty polytetrafluoroethylene (PTFE) lined, metallic reinforced, hose assemblies suitable for use in 400 °F, 3000 psi aircraft hydraulic systems. Assemblies are suitable where rapid rate pressure pulsing and torsional/longitudinal flexing may occur, in addition to normal hydraulic system loads.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification 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 specification and references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2486	Conversion Coating of Titanium Alloys, Fluoride-Phosphate Type
AMS 2488	Anodic Treatment, Titanium and Titanium Alloys
AMS 4928	Bars and Forgings - 6Al 4V, Annealed - 120,000 psi
AMS 4945	Tubing, Seamless, Hydraulic, 3Al 2.5V, Texture Controlled, 105,000 psi (724 MPa) Yield Strength
AMS 4965	Bars, Forgings and Rings - 6Al 4V, Sol. and Precip. Heat Treated
AMS 5556	Steel Tubing, Seamless or Welded, Corrosion and Heat-Resistant, 18Cr - 11Ni - (Cb+Ta) (SAE 30347) Hydraulic
AMS 5557	Steel Tubing, Seamless or Welded, Corrosion and Heat-Resistant, 18Cr - 11Ni (SAE 30321) Hydraulic

2.1 (Continued):

AMS 5567	Steel Tubing, Seamless and Welded, Corrosion Resistant, 19Cr - 10Ni (SAE 30304) Hydraulic, Solution Treated
AMS 5570	Steel Tubing, Seamless, Corrosion and Heat-Resistant 18Cr - 11Ni - 0.401Ti (SAE 30321)
AMS 5571	Steel Tubing, Seamless, Corrosion and Heat-Resistant, 18Cr - Ni - 0.70(Cb+Ta) (SAE 30347)
AMS 5575	Steel Tubing, Welded, Corrosion and Heat-Resistant, 18Cr - 10.5Ni - 0.70(Cb+Ta) (SAE 30347)
AMS 5639	Steel Bars, Forgings, Tubing, and Rings, Corrosion-Resistant, 19Cr - 10Ni (SAE 30304)
AMS 5643	Steel Bars, Forgings, Tubing, and Rings, Corrosion Resistant, 16.5Cr - 4.0Ni - 4.0Cu
AMS 5644	Steel Bars and Forgings, Corrosion and Heat Resistant 17Cr - 7Ni - 1Al
AMS 5645	Steel Bars, Forgings, Tubing and Rings, Corrosion and Heat Resistant 18Cr - 10Ni - 0.40Ti (SAE 30321)
AMS 5646	Steel Bars, Forgings, Tubing and Rings, Corrosion and Heat Resistant 18Cr - 11Ni - 0.60(Cb+Ta) (SAE 30347)
AMS 5647	Steel Bars, Forgings, Tubing and Rings, 18Cr - 8Ni
AMS 5659	Steel Bars, Forgings, and Rings, Corrosion Resistant 15Cr - 4.5Ni - 0.30(Cb+Ta) - 3.5Cu Consumable Electrode Melted
AMS 5688	Steel Wire, Corrosion-Resistant, 18Cr - 9.0Ni (SAE 30302) Spring Temper
AMS 5689	Steel Wire, Corrosion and Heat-Resistant, 18Cr - 9.5Ni - Ti (SAE 30321) Solution Heat Treated
AMS 5743	Steel Bars and Forgings, Corrosion and Moderate Heat-Resistant 15.5Cr - 4.5Ni - 2.9Mo - 0.10N, Solution Heat Treated, Sub-Zero Cooled, Equalized and Over-Tempered
AMS-QQ-P-35	Passivation Treatments for Corrosion - Resistant Steel
ARP603	Impulse Testing of Hydraulic Hose Assemblies, Tubing and Fittings
AS150	Hose Assembly, Type Classification of, Basic Performance and Fire Resistance
AS611	Polytetrafluoroethylene Hose Assembly Cleaning Methods
ARP908	Torque Requirements, Installation and Qualification Test, Hose and Tube Fittings
AS1055	Fire Testing of Flexible Hose Tube Assemblies, Coils, Fittings, and Similar Systems
AS1072	Sleeve, Hose Assembly, Fire Protection
AIR1228	Standard Impulse Machine Equipment Operation
AS2078	Test Methods, Hose Assemblies, Polytetrafluoroethylene (PTFE)
ARP1835	Preparation for Delivery, General Requirements for Hose Assemblies
AS4265	Impulse Testing of Hydraulic Tubing and Fittings, S-N Curve
AIR4298	Impulse Test Machine, Sine Wave, Equipment and Operation of
AS4375	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal

2.1 (Continued):

AS4395	Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seal
AS4488	Tubular Assemblies, Fusion Welded, Inspection Processes and Acceptance Standards for
AS4658	Fitting End, External Thread, Short Flareless, Design Standard
AS4703	Fitting End, Acorn, Short Flareless, Design Standard
AS8879	Screw Threads, Controlled Radius Root With Increased Minor Diameter, General Specification of

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

ASTM A 262	Detecting Susceptibility to Intergranular Attack on Stainless Steel
ASTM A 580	Standard Specification for Stainless and Heat Resisting Steel Wire
ASTM B 348	Specification for Titanium and Titanium Alloy Bars and Billets, Grade 2

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

P-D-680	Dry Cleaning Solvent
QQ-S-763	Steel Bars, Wire Shapes, and Forgings, Corrosion-Resisting
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordinance (Inactive For New Design)
MIL-PRF-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-PRF-83282	Hydraulic Fluid, Fire-Resistant, Synthetic, Hydrocarbon Base, Aircraft
MIL-F-85421	Fittings, Tube, Fluid Systems, Separable, Beam Seal, 3000/4000 psi, General Requirements for
MIL-F-85421/1	Fitting End, Standard Dimensions for Dynamic Beam Seal, Male
MIL-STD-100	Engineering Drawing Practices for Inspection
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-831	Test Reports, Preparation of

2.4 National Aerospace Standards:

Available from Aerospace Industries Association, 1250 Eye Street N.W., Washington, DC 20005.

NAS1760	Fitting End, Flareless Acorn, Standard Dimensions for
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2.5 ASME Publications:

Available from ASME, 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900.

ASME B46.1 Surface Finish

3. TECHNICAL REQUIREMENTS:

3.1 Qualification:

The hose assemblies furnished under this document shall be products which are qualified by meeting all the requirements covered by this document, such as AS4605 through AS4622.

3.2 Material and Finish:

The hose assembly materials shall be uniform in quality, free from defects, consistent with good manufacturing practice, and shall conform to applicable specifications and requirements specified herein.

3.2.1 Metals: Metals used in the hose and fittings shall be corrosion-resistant and shall conform to the applicable specifications as follows:

a. Bars and Forgings:

QQ-S-763	Class 304 - Condition A or Condition B (AMS 5639)
QQ-S-763	Class 304L - Condition A (AMS 5647)
QQ-S-763	Class 321 - Condition A (AMS 5645)
QQ-S-763	Class 347 - Condition A (AMS 5646)
AMS 4928	6Al-4V Titanium - Annealed
AMS 4965	6Al-4V Titanium - Solution Treated
AMS 5643	17-4 PH Solution Heat Treated
AMS 5644	17-7 PH Solution Heat Treated
AMS 5659	15-5 PH Solution Heat Treated
AMS 5743	AM 355 - Solution Heat Treated

b. Tubing:

AMS 5567	Type 1 or Type 2 Stainless Steel Tubing, 304
AMS 5557	Type 1 or Type 2 Stainless Steel Tubing, 321
AMS 5570	Seamless Stainless Steel Tubing, 321
AMS 5571	Seamless Stainless Steel Tubing, 347
AMS 5575	Welded Stainless Steel Tubing, 347
AMS 5556	Type 1 or Type 2 Stainless Steel Tubing, 347
AMS 4945	Titanium 3Al-2.5V Texture Controlled

3.2.1 (Continued):

c. Wire:

ASTM A 580 Comp. 302 (AMS 5688)
ASTM A 580 Comp. 304 (AMS 5639)
ASTM A 580 Comp. 321 (AMS 5689)

3.3 Design and Construction:

The hose assembly shall consist of a seamless PTFE inner tube, multi-layered corrosion-resistant steel-wire reinforcement, and corrosion-resistant steel and/or titanium end fittings as required to meet the construction and performance requirements of this document and as required for its intended use.

3.3.1 Inner Tube: The inner tube shall be of a seamless construction of virgin PTFE resin of uniform gage. It shall have a smooth bore and shall be free from pitting or projections on the inner surface. Additives may be included in the compound from which the tube is extruded.

3.3.2 Reinforcement: The reinforcement shall consist of multiple layers of corrosion-resistant steel wires conforming to the applicable specifications listed in 3.2.1. The wires shall be so arranged over the inner tube as to provide sufficient strength to ensure conformance with the requirements specified herein. Broken reinforcing wires shall be cause for rejection. Crossed-over reinforcing wires shall not be cause for rejection of the hose assembly.

NOTE: High density (plait consist of more than 12 wires) braid construction is not permitted.

3.3.3 Fittings: All fittings shall be permanently attached and proven to meet the requirements herein. Standard hose assemblies shall have flared fittings to mate with AS4395, flareless fittings according to NAS1760 to mate with AS4375 or short flareless fittings according to AS4703 to mate with AS4658 or beam seal fittings to mate with male fittings per MIL-F-85421. Fitting hexagonal portions shall fit standard wrench openings.

3.3.3.1 Insert Fittings: Standard insert fittings shall be of one piece construction. Welded or brazed joints must not be located in the fluid path.

3.3.3.2 Other Fittings: Other fittings including elbow fittings shall be of one piece construction to the maximum extent possible. Those made with other than one piece construction can use welded and redrawn CRES tubing in accordance with 3.2.1 or titanium tubing per AMS 4945 and shall employ a butt-weld joint method in accordance with AS4488.

3.3.3.3 End Fitting Collars (Sockets): All end fitting collars (sockets) crimped or swaged, fabricated from Type 304 stainless steel are required to be capable of passing an embrittlement test as specified in ASTM A 262 Practice E, prior to assembly to the nipple or swaging operation. Sockets fabricated from stabilized austenitic steel (304L, 321, or 347) or titanium are acceptable without being subjected to the embrittlement test. Titanium sockets are per ASTM B 348 - Grade 2.

3.3.3.4 Finish:

- 3.3.3.4.1 Corrosion Resistant Steel Parts: Unless otherwise specified, corrosion resistant steel parts shall be passivated in accordance with AMS-QQ-P-35.
- 3.3.3.4.2 Titanium Alloy Parts: Titanium alloy parts shall be fluoride phosphate coated per AMS 2486 or anodized per AMS 2488 Type 2, unless otherwise specified.

3.4 Assembly Dimensions:

The hose assembly dimensions, except for length, shall be as specified in Figure 1 and Table 1.

- 3.4.1 Hose Weight: Hose consisting of inner tube and reinforcement as outlined in 3.3.1 through 3.3.2 shall not exceed the maximum hose weights specified in Table 2.

3.5 Performance:

The inner tube and hose assembly shall meet the following performance requirements:

3.5.1 Inner Tube:

- 3.5.1.1 Tube Roll: The tube shall not leak, split, burst, or show any evidence of malfunction, when tested through the sequence as specified in 4.6.2.1.
 - 3.5.1.2 Tube Proof Pressure: The tube, without reinforcing wires, shall not leak, burst, or show any evidence of malfunction when tested to the AS2078 (3000 psi and higher) proof pressure values for 1 min. The test method is specified in 4.6.2.1.
 - 3.5.1.3 Tensile Strength: The longitudinal tensile strength for all sizes of tubes shall be 2200 psi minimum when tested in accordance with 4.6.2.2. The transverse tensile strength for sizes -10 and larger shall be 1800 psi minimum. For sizes under -10 the transverse strength need not be tested.
 - 3.5.1.4 Elongation: Elongation shall be a minimum of 200% when tested in accordance with 4.6.2.3.
 - 3.5.1.5 Specific Gravity: The apparent specific gravity of the hose inner tube shall not exceed 2.155; the relative specific gravity shall not exceed a value of 2.190 when tested as specified in 4.6.2.4.
- 3.5.2 Hose Assembly: The hose, complete with reinforcing wires and assembled with end fittings, shall meet the following performance requirements:
- 3.5.2.1 Proof Pressure: The hose assembly shall withstand the proof pressure listed in Table 2 without malfunction or leakage, when tested as specified in 4.6.3.