



AEROSPACE STANDARD

MA4098

Issued	1995-10
Reaffirmed	2015-08

Hose Assembly, Polytetrafluoroethylene, Heavy Duty, Metallic Reinforced,
204 °C, 35 000 kPa Hydraulic and Pneumatic, Metric

RATIONALE

MA4098 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

This Aerospace Standard (MA) defines the requirements for a heavy duty polytetrafluoroethylene (PTFE) lined, metallic reinforced, hose assembly suitable for use in 204 °C, 35 000 kPa, aircraft and missile hydraulic fluid systems.

2. REFERENCES:

2.1 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 documents shall be as specified in AMS 2350.

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

AMS 4928	Ti Alloy Bars, Forgings and Rings, 6Al - 4V, Anneal 120,000 psi
AMS 4945	Titanium Alloy Tubing, Seamless, Hydraulic 3Al - 2.5V, Texture Controlled, 105,000 psi Yield Strength
AMS 4965	Ti Alloy Bars, Forgings and Rings, 6Al - 4V, Solution and Precipitation 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 and Welded, Corrosion and Heat-Resistant 18Cr - 11Ni-Ti (SAE 30321) Hydraulic
AMS 5561	Steel Tubing Welded and Drawn, 9.0Mn - 20Cr - 6.5Ni - 0.28N, High Pressure Hydraulic
AMS 5567	Steel Tubing, Seamless and Welded, Corrosion-Resistant 19Cr - 10Ni (SAE 30304) Hydraulic, Solution Treated

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Documents

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2.1.1 (Continued):

AMS 5570	Steel Tubing, Seamless, Corrosion and Heat-Resistant 18Cr - 11Ni - 0.40Ti (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 5576	Tubing Welded, 18Cr - 10.5Ni - 0.40Ti Solution Heat Treated
AMS 5636	Steel Bars, Corrosion-Resistant, 18Cr - 9.0Ni (SAE 30302)
AMS 5637	Steel Bars, Corrosion-Resistant, 18Cr - 9.0Ni (SAE 30302)
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) - 3.5 Consumable Electrode Melted
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
AS611	Tetrafluoroethylene Hose Assembly Cleaning Methods
ARP908	Hose Fitting - Installation and Qualification Test Torque Requirements
AS1055	Fire Resistance and Fire Test
ARP1835	Preparation for Delivery, General Requirements for Hose Assemblies
AS4488	Tubular Assemblies, Fusion Welded, Inspection Process and Acceptance Standard
MA1370 (ISO 5855)	Screw Threads - MJ Profile, Metric
MA2014 (ISO 7321)	Fitting Ends - Flareless Acorn, Metric
MA2078 (ISO 8829)	Test Methods, Hose Assemblies
MA2095	Fitting Design Standard, 24° Cone, Standard Dimensions
MA2096	Fitting End, 24° Cone, Bulkhead, Standard Dimensions
MA2273	Beam Seal, Male, Design Standard, Metric
MA2274	Beam Seal, Male, Bulkhead Design Standard, Metric

2.1.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 262	Detecting Susceptibility to Intergranular Attack on Stainless Steel
ASTM A 580	Stainless and Heat-Resistant Steel Wire - Type 304 or 316, Condition B

2.1.3 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-C-5501	Caps and Plugs, Protective, Dust and Moisture Seal
MIL-F-85720	Fittings, Tube, Fluid Systems, Separable, High Pressure Beam Seal
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordnance
MIL-H-83282	Hydraulic Fluid, Fire-Resistant, Synthetic Hydrocarbon Base Aircraft
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-T-8504	Tubing, Steel, Corrosion-Resisting (304) Aerospace Vehicle Hydraulic Systems, Annealed, Seamless and Welded
MIL-T-8808	Tubing, Steel, Corrosion-Resistant (18-8 Stabilized) Aircraft Hydraulic Quality
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
MIL-STD-2219	Fusion Welding for Aerospace Application
H4/H8	Cataloging Handbook

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.

3.2 Materials:

The hose assembly materials shall be uniform in quality, free from defects, consistent with good manufacturing practice, shall conform to applicable specifications and the requirements specified herein, and shall be of the highest quality and suitable for the purpose intended.

3.2.1 Metals: Metals used in the hose and fittings shall be corrosion-resistant and shall conform to the following specification:

a. Bars and Forgings:

- | | | |
|------|----------|---|
| (1) | QQ-S-763 | Class 302 - Cond. A and Cond. B (AMS 5636 and AMS 5637) |
| (2) | QQ-S-763 | Class 304 - Cond. A and Cond. B (AMS 5639) |
| (3) | QQ-S-763 | Class 304L - Cond. A (AMS 5647) |
| (4) | QQ-S-763 | Class 321 - Cond. A (AMS 5645) |
| (5) | QQ-S-763 | Class 347 - Cond. A (AMS 5646) |
| (6) | AMS 5643 | 17-4PH |
| (7) | AMS 5644 | 17-7PH |
| (8) | AMS 5659 | 15-5PH |
| (9) | AMS 5743 | AM-355 |
| (10) | AMS 4928 | Titanium 6Al 4V Annealed |
| (11) | AMS 4965 | Titanium 6Al 4V Heat Treated |

b. Tubing:

- | | | |
|-----|------------|--|
| (1) | MIL-T-8504 | Comp. 304 (AMS 5567) |
| (2) | MIL-T-8808 | Type I or Type II, Comp. 321 (AMS 5557, AMS 5570, or AMS 5576) |
| (3) | MIL-T-8808 | Type I or Type II, Comp. 347 (AMS 5571, AMS 5575, or AMS 5556) |
| (4) | AMS 4945 | Titanium 3Al 2.5V Texture Controlled |
| (5) | AMS 5561 | Welded and Redrawn Stainless Steel Tubing, 21-6-9 |

c. Wire:

- | | | |
|-----|------------|--|
| (1) | ASTM A 580 | Specification for Stainless and Heat-Resisting Steel Wire, Type 304 or 316 Condition B |
|-----|------------|--|

3.3 Construction:

The hose assembly shall consist of a seamless PTFE inner tube, corrosion-resistant steel-wire reinforcement, and corrosion-resistant metal 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 gauge. It shall have a smooth bore and shall be free from pitting, deep scratches, 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 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.

- 3.3.3 Interlayers: Interlayers, if used, shall be of a suitable material and shall be resistant to pressure pounding and to all fluids with which the hose may come in contact during normal service. They shall be capable to withstanding temperatures of -54 to 204 °C and shall not extrude through the outer braid during testing or in service.
- 3.3.4 Fittings: All fittings shall be proven to meet the requirements herein. Standard hose assemblies shall have a reconnectable configuration of beam seal fittings to mate with MA2273 or MA2274, flareless per MA2014 to mate with MA2095 or MA2096, or other suitable end connections. Fitting hex portions shall fit standard wrench openings.
- 3.3.4.1 Straight Fittings: Straight fittings shall be of one piece construction. Weld or braze joints must not be located in the fluid paths.
- 3.3.4.2 Other Fittings: Other fittings including elbow fittings shall be of one piece construction to the maximum extent possible. However, those made with other than one piece construction can use stainless steel welded and redrawn tubing per AMS 5561 or titanium seamless tubing per AMS 4945. When weld joints are required the butt weld will be per MIL-STD-2219 or AS4488. If welding is used, a stabilized grade of stainless steel shall be used.
- 3.3.4.3 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) are acceptable without being subjected to the embrittlement test. Titanium sockets are not recommended.
- 3.3.5 Dimensions: The hose assembly dimensions, except for length, shall be as specified in Figure 4 and Table 5.
- 3.3.6 Hose Weight: Hose consisting of inner tube, reinforcement, and interlayers as outlined in 3.3.1 through 3.3.3 shall not exceed the maximum hose weights covered in Table 1A.

3.4 Performance:

The hose assembly shall meet the following performance requirements:

3.4.1 Tube:

- 3.4.1.1 Tube Roll and Proof Pressure Test: The tube shall not leak, split, burst, or show any evidence of malfunction when rolled to the flattening and rounding gaps of MA2078 (21 000 kPa and higher) values. The test method is specified in 4.6.2.1.
- 3.4.1.2 Tube Proof Pressure: The tube, without reinforcing wires, shall not leak, burst, or show any evidence of malfunction when tested to the MA2078 (21 000 kPa and higher) proof pressure values for 1 min. The test method is specified in 4.6.2.1.

TABLE 1 - Hose Weights and Pressures

TABLE 1A - Physical Requirements

Hose Size mm	Hose Size in (ref)	Hose Weight Max ¹ kg/m	Bend Rad Min Inside of Bend mm	Volumetric Expansion Max mL/m
DN06	-04	.40	76	3.9
DN10	-06	.66	127	5.9
DN12	-08	.81	146	9.1
DN16	-10	1.25	165	13.8
DN20	-12	1.70	197	18.9
DN25	-16	2.86	245	29.5
DN32	-20	3.95	305	49.1

¹ Hose weight shall be determined on a minimum length of 300 mm.

TABLE 1B - Pressure Requirements (kPa)

Operating Max	Proof Min	Burst Min Room Temperature	Burst Min Elevated Temperature
35 000	70 000	140 000	105 000

- 3.4.1.3 Tensile Strength: The longitudinal tensile strength for all sizes of tubes shall be 15 200 kPa minimum. The transverse tensile strength for sizes DN16 and larger shall be 12 500 kPa minimum. For sizes DN12 and smaller the transverse tensile strength need not be tested. The test method is specified in 4.6.2.2.
- 3.4.1.4 Elongation: Elongation shall be a minimum of 200%. The test method is specified in 4.6.2.3.
- 3.4.1.5 Specific Gravity: The specific gravity values of the hose inner tube shall not exceed 2.155 apparent and 2.190 relative. The test method is specified in 4.6.2.4.
- 3.4.2 Hose Assembly: The hose, complete with reinforcing wires and assembled with end fittings, shall meet the following performance requirements:
- 3.4.2.1 Proof Pressure: The hose assembly shall withstand the proof pressure listed in Table 1B without malfunction or leakage. The test method is specified in 4.6.3.
- 3.4.2.2 Elongation and Contraction: The hose assembly shall not change in length by more than $\pm 2\%$ in 250 mm of hose length when subjected to the operating pressure in Table 1B for a minimum of 5 min. The test method is specified in 4.6.4.
- 3.4.2.3 Volumetric Expansion: The volumetric expansion of the hose assemblies shall not exceed the limits specified in Table 1A. The test method is specified in 4.6.5.