



AEROSPACE STANDARD

MA4095

Issued	1996-11
Reaffirmed	2015-08

Hose Assembly, Polytetrafluoroethylene, Para-Aramid Reinforced
135 °C, 34 500 kPa, Hydraulic and Pneumatic

RATIONALE

MA4095 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

This SAE Metric Aerospace Standard (MA) defines the requirements for heavy-duty polytetrafluoroethylene (PTFE) lined, para-aramid reinforced, hose assembly suitable for use in 135 °C, 34,500 kPa, aircraft and missile hydraulic fluid systems.

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, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2486	Conversion Coating of Titanium Alloys - Fluoride - Phosphate Type
AMS 3380	Hose, Polytetrafluoroethylene, TFE Fluorocarbon Resin, Wire Braid Reinforced
AMS 4928	Ti Alloy Bars, Forgings and Rings, 6Al - 4V, Annealed - 120,000 psi
AMS 4944	Ti Alloy Tubing, Seamless Hydraulic 3.0Al - 2.5V Cold-Worked, Stress Relieved
AMS 4945	Titanium Alloy Tubing, Seamless, Hydraulic, 3A1 - 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

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Documents

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2.1.1 (Continued):

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
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, Forgings, Corrosion-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
ARP603	Impulse Testing of Hydraulic Hose Tubing and Fittings Assemblies
AS611	Tetrafluoroethylene Hose Assembly Cleaning Methods
ARP908	Torque Requirements, Installation and Qualification Test, Hose, and Tube Fitting
AS1055	Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components
AIR1228	Standard Impulse Machine Equipment and Operation
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft
AS1703	In-Flight Thrust Determination
ARP1835	Preparation for Delivery, General Requirements for Hose Assemblies
MA2014	Fitting End, Flareless Acorn, Metric

2.1.1 (Continued):

MA2078	Test Methods, Hose Assemblies, Polytetrafluoroethylene (PTFE)
MA2096	Fitting End, 24° Cone, Bulkhead, Metric, Standard Dimension for, Design Standard
MA2273	Fitting End, Beam Seal, External Thread, Design Standard, Metric

2.1.2 ASTM Publications: Available from American Society for Testing and Materials, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

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-P-35	Passivation Treatment for Corrosion Resistant Steel
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 Dynamic
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-L-46010	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting
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
MIL-STD-831	Test Reports, Preparation of
MS19059	Balls, Bearing, Ferrous, Chrome Alloy Steel
MS33656	Fitting End, Standard Dimension for Flared Tube Connection and Gasket Seal

2.1.4 ANSI Publications: Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002. i8

ANSI/ASME B46.1

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 and 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 specifications:

a. Bars and Forgings:

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

b. Tubing:

MIL-T-8504	Comp. 304 (AMS 5567)
MIL-T-8808	Type I or Type II, Comp. 321 (AMS 5557, AMS 5570, or AMS 5576)
MIL-T-8808	Type I or Type II, Comp. 347 (AMS 5571, AMS 5575, or AMS 5556)
AMS 4944	Titanium 3Al 2.5V Cold Worked and Stress Relieved
AMS 4945	Titanium 3Al 2.5V Texture Controlled
AMS 5561	Welded and Redrawn Stainless Steel Tubing, 21-6-9

c. Wire:

ASTM A 580	Specification for Stainless and Heat-Resisting Steel Wire, Type 304 or 316 Condition B
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3.2.2 Reinforcement: Para-aramid textile treated and applied to the hose with an outer polyester braid or polybenzimidazol/para-aramid blend braid cover to meet all of the requirements herein.

3.2.3 Finish:

3.2.3.1 Cres stainless steel, passivate per QQ-P-35.

3.2.3.2 Titanium fluoride phosphate conversion coating shall be per AMS 2486 when applicable.

3.3 Construction:

The hose assembly shall consist of a seamless polytetrafluoroethylene (PTFE), inner tube, treated para-aramid reinforcement, polyester or polybenzimidazol/para-aramid blend braid cover and corrosion-resistant metal 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 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 a treated para-aramid braid and/or wraps with braided polyester or polybenzimidazol/para-aramid blend braid cover conforming to the applicable specifications listed in 3.2.2. The reinforcement shall be so arranged over the inner tube as to provide sufficient strength to ensure conformance with the requirements specified herein. Broken reinforcing cords shall be cause for rejection. The outer braid shall provide 100% coverage to protect the para-aramid from exposure to ultraviolet light. A continuous lay line interrupted with MA4095 and the hose manufacturer's name and trademark shall be permanently marked in contrasting color along the length of the hose.
- 3.3.3 Fittings: All fittings shall be permanently attached by crimp or swage and proven to meet the requirements herein. Standard hose assemblies shall have flared fittings to mate with MS33656; flareless fittings according to NAS 1760 to mate with MS33514; or a reconnectable configuration of beam seal fittings to mate with MIL-F-85720/1; or other suitable end connections. Fitting hex portions shall fit standard wrench openings. All internal surfaces of fitting nuts shall be dry filmed with dry film per MIL-L-46010. Dry film on external surfaces is optional.
 - 3.3.3.1 Straight Fittings: Nipples shall be of one-piece construction. Weld or braze joints must not be located in the fluid paths, except welded and redrawn tubing per MIL-T-8504 or MIL-T-8808 may be used.
 - 3.3.3.2 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 shall use stainless steel welded and redrawn tubing per AMS 5561 or titanium seamless tubing per AMS 4944 or AMS 4945. When weld joints are required, the butt weld method will be used.
 - 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) are acceptable without being subjected to the embrittlement test. Titanium sockets are not recommended.

3.4 Dimensions:

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

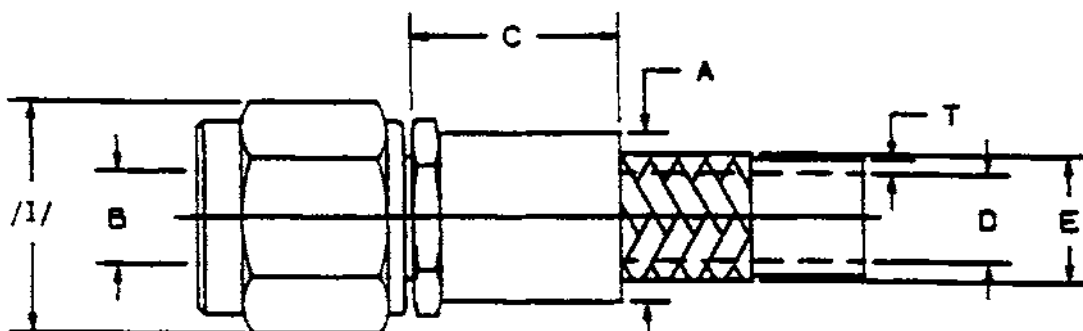


FIGURE 1 - Hose and Fitting Dimensions

TABLE 1 - Hose and Fitting Dimensions (mm)

Hose Size	Rigid Tube OD (Ref)	Fitting OD A Max	Fitting ID B Min /2/	Socket Length C Max	Hose ID D Min	Hose OD E Min	Hose OD E Max	Unbraided Inner Tube Wall T Min	Spherical Ball Size for Determining Min ID /2/ MS19059 Dash No.	Spherical Ball Size for Determining Min ID /2/ mm
DN06	6.250	21.875	3.375	56.25	5.300	5.300	12.75	1.000	4807	2.725
DN10	9.375	25.000	6.000	62.50	7.450	7.450	15.50	1.000	4812	4.700
DN12	12.500	30.000	8.500	68.75	9.775	9.775	19.00	1.000	4816	7.825
DN16	15.625	35.150	10.250	75.00	12.125	12.125	24.00	1.125	4818	9.375
DN20	18.750	42.175	12.750	81.25	15.050	15.050	28.00	1.125	4821	11.725
DN25	25.000	50.000	15.000	93.75	21.300	21.300	34.25	1.125	4829	17.975

NOTES:

/1/ Cross corners of nut and socket hex may exceed "A" dimension.

/2/ Minimum specified inside diameter shall be verified by passing the applicable MS19059 spherical ball through the hose assembly.

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

TABLE 2 - Hose Weights

TABLE 2A - Physical Requirements

Hose Size	Tube Size Nominal mm	Hose Weight Max kg/cm	Bend Rad Min Inside of Bend cm	Volumetric Expansion Max in ³ /cm
DN06	6.250	.004	7.500	.003
DN10	9.375	.007	12.500	.004
DN12	12.500	.008	14.375	.006
DN16	15.625	.013	16.250	.009
DN20	18.750	.017	18.750	.012
DN25	25.000	.029	24.063	.019

TABLE 2B - Pressure Requirements (kPa)

Operating Max	Proof Min	Burst Min Room Temperature	Burst Min Elevated Temperature
34,500	65,000	130,000	100,000

3.5 Performance:

The hose assembly shall meet the following performance requirements:

3.5.1 Tube:

- 3.5.1.1 Tube Roll: 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 or higher) values. The test method is specified in 4.6.2.1.
- 3.5.1.2 PTFE Tube Proof Pressure: The tube, without reinforcement, shall not leak, burst, or show any evidence of malfunction, when tested to MA2078 (21,000 kPa or higher) proof-pressure values. 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 15,180 kPa minimum at 25 °C ± 5. The transverse tensile strength for sizes DN16 and larger shall be 12,420 kPa minimum at the same temperature. For sizes DN12 and smaller, the transverse tensile strength need not be tested. The test method is specified in 4.6.2.2.
- 3.5.1.4 Elongation: Elongation shall be a minimum of 200%. Test method is specified in 4.6.2.3.
- 3.5.1.5 Specific Gravity: The specific gravity values of the hose inner tube shall not exceed 2.155 apparent and 2.190 specific. The test method is specified in 4.6.2.4.