



AEROSPACE STANDARD

MA1975

Issued 1994-05
Reaffirmed 2015-07

Superseding MA2140

Hose Assemblies, Polytetrafluoroethylene, Aramid Reinforced, 135 °C,
Standard Duty, 28 000/21 000 kPa, Hydraulic, Aircraft Systems

RATIONALE

MA1975 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

This document defines the requirements for a PTFE lined, aramid reinforced assembly suitable for use up to 135 °C and up to 28 000 kPa aircraft and missile hydraulic and pneumatic systems.

1.1 Product Classification:

For service to 21 000 kPa, this hose assembly is suitable for use at reduced bend radius per Table 1.

1.2 Field of Application:

1.2.1 For use with phosphate ester or silicate ester hydraulic fluids, the oil immersion samples in 3.5.2.5 and 3.5.2.7 must be preconditioned per 4.5.2.3 using the specific system fluid. Due precaution must be taken in handling any toxic hydraulic fluid.

1.2.2 This is not recommended for gaseous service where minor effusion is detrimental.

2. REFERENCES:

The following documents of the issue in effect on date of invitation for bids or request for proposals form a part of this document to the extent specified herein.

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TABLE 1 - Physical and Performance Requirements

Hose Size DN	Operating Pressure kPa max	Proof Pressure -0 +7000 kPa min	/2/ Burst Pressure		/2/ Burst Pressure High Temp. kPa min	Bend Radius		Vol. Expan. cc/cm max	/1/ Hose Weight kg/m max
			Room Temp. kPa min	Room Temp. kPa min		Inside Bend 21 000 kPa mm min	Inside Bend 28 000 kPa mm min		
6	28 000	55 000	110 000	110 000	83 000	38	76	0.035	0.108
10	28 000	55 000	110 000	110 000	83 000	64	127	0.052	0.145
12	28 000	55 000	110 000	110 000	83 000	73	146	0.074	0.215
16	28 000	55 000	110 000	110 000	83 000	83	165	0.151	0.357
20	28 000	55 000	110 000	110 000	83 000	102	197	0.194	0.447
25	28 000	55 000	110 000	110 000	83 000	190	305	0.446	0.715
32	28 000	55 000	110 000	110 000	83 000	TBD	TBD	TBD	TBD
40	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

/1/ Hose weight shall be determined on a hose length of 30.5 cm/min.

/2/ For 21 000 kPa service (bend radius as shown) only, room temperature burst of 84 000 kPa and high temperature burst of 63 000 kPa is acceptable.

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 4928	Bars and Forgings - 6Al 4V, Annealed - 120 000 psi
AMS 4945	Titanium Alloy Tubing, Seamless, Hydraulic, 3Al - 2.5V, Texture Controlled 105 000 psi (724 MPa) Yield Strength
AMS 4965	Bars, Forgings, and Rings, 6Al 4V, Solution and Precipitation Heat Treated
AMS 5536	Steel Bars, Corrosion Resistant, 18Cr - 8.5Ni (SAE 30302) Cold Drawn, 100 000 psi (690 MPa)
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 - Ti (SAE 30321) Hydraulic
AMS 5567	Steel Tubing, Seamless or 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 - 11Ni - 0.40Ti
AMS 5637	Steel Bars, Corrosion Resistant, 18Cr - 10Ni (SAE 30304)
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 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 Assemblies, Tubing and Fittings
AS611	Polytetrafluoroethylene Hose Assembly Cleaning Methods
ARP908	Hose Fitting - Installation and Qualification Test Torque Requirements
AS1055	Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings and Similar System Components
AS1072	Sleeve Hose Assembly, Fire Protection

2.1 (Continued):

AIR1228	Standard Impulse Machine Equipment and Operation
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft
ARP1835	Preparation for Delivery, General Requirements for Hose Assemblies
AS4488	Tubular Assemblies, Fusion Welded, Inspection Processes and Acceptance Standards for
MA1370	
MA2002	Impulse Testing of Hydraulic Hose, Tubing and Fitting Assemblies
MA2014	Fitting End, Flareless Acorn, Metric
MA2040	Nut, Sleeve Coupling Flareless
MA2047	Nut Swivel, Wired On
MA2078	Test Methods, Hose Assemblies
MA2095	Fitting Design Standard, 24° Cone Dimensions For
MA2096	Fitting End, 24° Cone, Bulkhead, Standard Dimensions For
MA2187	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 28 000/21 000 kPa, 135 °C, Titanium Fittings, Flareless, Straight to Straight
MA2188	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 28 000/21 000 kPa, 135 °C, Titanium Fittings, Flareless, Straight to 45°
MA2189	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 28 000/21 000 kPa, 135 °C, Titanium Fittings, Flareless, Straight to 90°
MA2190	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 28 000/21 000 kPa, 135 °C, Titanium Fittings, Flareless, 45° to 90°
MA2191	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 28 000/21 000 kPa, 135 °C, Titanium Fittings, Flareless, 45° to 45°
MA2192	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 28 000/21 000 kPa, 135 °C, Titanium Fittings, Flareless, 90° to 90°
MA2273	Beam Seal, Male, Design Standard, Metric
MA2274	Beam Seal, Male, Bulkhead Design, Standard, Metric
MA4568	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 4000/3000 psi, 275 °F, Titanium Fittings, Flareless, Straight to Straight
MA4569	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 4000/3000 psi, 275 °F, Titanium Fittings, Flareless, Straight to 45°
MA4570	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 4000/3000 psi, 275 °F, Titanium Fittings, Flareless, Straight to 90°
MA4571	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 4000/3000 psi, 275 °F, Titanium Fittings, Flareless, 45° to 90°
MA4572	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 4000/3000 psi, 275 °F, Titanium Fittings, Flareless, 45° to 45°
MA4573	Hose Assembly, PTFE, Aramid Reinforced, Standard Duty, 4000/3000 psi, 275 °F, Titanium Fittings, Flareless, 90° to 90°

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 262	Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ASTM B 348	Titanium Alloy
ASTM D 638	Precipitation Hardening Iron Base Superalloy Bars, Forgings, and Forging Stock for High Temperature Service, Standard Specification for
ASTM D 1457	TFE - Fluorocarbon Resin Molding and Extrusion Materials

2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

P-D-680	Dry Cleaning Solvent
QQ-P-35	Passivation Treatments for Corrosion Resistant Steels
QQ-S-763	Steel Bars, Wire Shapes, and Forgings, Corrosion-Resisting
TT-I-735	Isopropyl Alcohol
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft Missile, and Ordnance
MIL-T-8504	Tubing, Steel, Corrosion-Resisting (304) Aerospace Vehicle Hydraulic Systems, Annealed, Seamless and Welded
MIL-T-8606	Tubing, Steel, Corrosion-Resistant (18-8 Stabilized and Extra Low Carbon)
MIL-T-8808	Tubing, Steel, Corrosion-Resistant (18-8 Stabilized), Aircraft Hydraulic Quality
MIL-F-8815	Filter and Filter Elements, Fluid Pressure, Hydraulic Lines, 15 Micron Absolute and 5 Micron Absolute, Type II Systems
MIL-H-83282	Hydraulic Fluid, Fire-Resistant, Synthetic, Hydrocarbon Base, Aircraft
MIL-F-85421	Dynamic Beam Fitting
MIL-L-46010	Dry Film Lubricant
MIL-STD-100	Engineering Drawing Practices for Inspection
MIL-STD-105	Sampling Procedures and Tables by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-831	Test Reports, Preparation of
MIL-STD-1595	Qualification of Aircraft, Missile and Aerospace Fusion Welders
MIL-STD-1839	Calibration and Measurement Requirements
MIL-STD-2219	Fusion Welding for Aerospace Applications
MS19059	Balls, Bearing, Ferrous, Chrome Alloy Steel

2.4 NAS Publications:

Available from AIA, 1250 Eye Street N.W., Washington, DC 20005.

ANSI/ASME B46.1 Surface Texture

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 Bars and Forgings

AMS 4965 - TI 6AL 4V Heat Treated Bars, Forgings and Rings

ASTM B 348 - Grade 2 - Titanium Alloy

b. Tubing:

MIL-T-8504 - Comp. 304 (AMS 5567)

MIL-T-8606 - Type I, Comp. 321 (AMS 5570)

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 4942 - Titanium Tubing, Seamless, Annealed, 40 000 psi (275 MPa) Yield Strength

AMS 4943 - Titanium Alloy Tubing, Seamless, Hydraulic 3.0 Al - 2.5V Annealed

AMS 4945 - Titanium Alloy Tubing, Seamless, Hydraulic, 3Al 2.5V, Texture Controlled,
105 000 psi (724 MPa) Yield Strength

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 If titanium fluoride phosphate conversion coat is used, it shall be per AMS 2486.

3.3 Design and Fabrication:

The hose assembly shall consist of a seamless polytetrafluoroethylene inner tube, treated para-aramid reinforcement, polyester or polybenzimidazol/para-aramid blend outer braid cover with optional PTFE tape interlayer and corrosion-resistant steel and/or titanium end fittings, as required, to meet the construction and performance requirements of this document.

3.3.1 Inner Tube: The inner tube shall be of a seamless construction of virgin polytetrafluoroethylene 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 optional PTFE tape interlayer and braided polyester or polybenzimidazol/para-aramid blend outer cover conforming to the applicable specifications listed in 3.2.2. The reinforcement shall be arranged over the inner tube to provide sufficient strength and protection for ensuring 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 reinforcement from exposure to ultraviolet light. A continuous lay line interrupted with AS1975, MA1975 or AS/MA1975 and hose manufacturer's name or trademark shall be permanently marked in contrasting color along hose length.

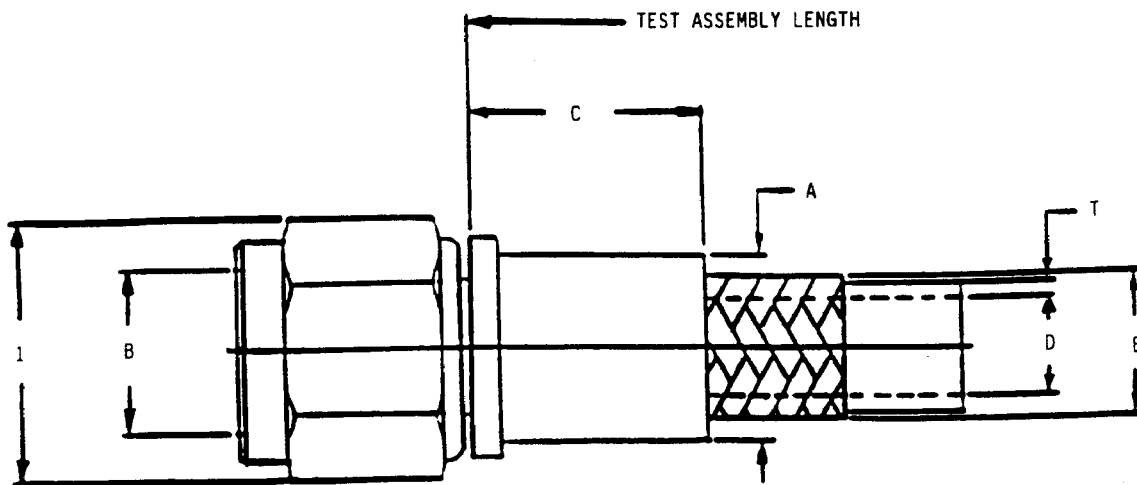
3.3.3 Fittings: All fittings shall be permanently attached by crimp or swage and proven to meet the requirements herein. Standard hose assemblies shall have flared fittings, flareless fittings according to MA2014 to mate with MA2095 or MA2096 or dynamic beam fittings to mate with male end per MA2273 or MA2274 in accordance with applicable documents (see Section 2). Antitorque hexes/flats shall be provided and shall fit standard wrench openings. Titanium nut threads and bearing shoulders will be lubricated with dry film per MIL-L-46010 Type I. External coating is permitted.

3.3.3.1 Straight Fittings: Straight fittings shall be of one piece construction. Welded or brazed joints must not be located in the fluid paths, except welded and redrawn tubing, in accordance with MIL-T-8504, or MIL-T-8808 may be used. Elbow fittings may be classified per 3.3.3.2 for construction.

- 3.3.3.2 Other Fittings: Other fittings are preferred to be of one piece construction. If stainless steel tubes are used, they shall be welded and drawn per MIL-T-8504 or MIL-T-8808. If titanium tubes are used, they shall be seamless per AMS 4945. Fitting welds will be butt welds per MIL-STD-2219 or AS4488. If welding is used, a stabilized grade of stainless steel shall be used.
- 3.3.3.3 End Fitting Collars (Sockets): All end fitting collars (sockets), crimped or swaged, and fabricated from Type 304 stainless steel shall be capable of passing an embrittlement test as specified in ASTM A 262 Practice E, prior to assembly to the nipple and crimp or swaging operation. Sockets fabricated from stabilized austenitic steel (304 L, 321 or 347) or titanium are acceptable without being subjected to the embrittlement test. Titanium collars are per ASTM B 348 - Grade 2.

3.4 Dimensions:

The hose assembly dimensions, except for length, shall be as specified in Figure 1 and Table 2.



¹ Cross corners of hex may exceed "A" dimension.

FIGURE 1 - Hose and Fitting Dimensions

TABLE 2 - Hose and Fitting Dimensions in mm

DN Hose Size	(Fitting OD) A Max	/2/ (Fitting ID) B Min	(Socket Length) C Max	(Hose ID) D Min	(Hose OD) E Min	(Hose OD) E Max	Unbraided PTFE Wall Thickness T Min	Unbraided PTFE Wall Thickness T Max
6	18	3.4	32	5.4	10.3	11.8	0.89	1.17
10	21	6.1	37	7.6	12.6	14.1	0.89	1.17
12	25	8.6	46	9.9	16.6	18.2	1.02	1.30
16	30	10.4	58	12.3	21.6	23.4	1.14	1.42
20	35	12.9	64	15.3	25.3	27.3	1.14	1.42
25	42	19.3	77	21.6	32.6	34.7	1.14	1.42
32	TBD	TBD						
40	TBD							

/1/ Cross corners of hex may exceed ϕA .

/2/ Minimum specified inside diameter shall be verified by passing the applicable MS19059 spherical ball through the hose assembly as shown in Table 3.

TABLE 3 - Hose ID Ball Size

Hose Size	Spherical Ball Size for Determining Minimum ID MS19059 Dash No.	Spherical Ball Size for Determining Minimum ID mm
DN06	4807	2.77
DN10	4812	4.78
DN12	4816	7.95
DN16	4818	9.53
DN20	4821	11.91
DN25	4829	18.26
DN32	TBD	TBD
DN40	TBD	TBD

3.4.1 Hose Weight: Hose consisting of inner tube, reinforcement, and outer layers as outlined in 3.3.1 and 3.3.2 shall not exceed the maximum hose weights specified in Table 1.

3.5 Performance:

The hose assembly shall meet the following performance requirements:

3.5.1 Tube:

3.5.1.1 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 or higher). The test method is specified in 4.6.2.1.