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SAE MA4623

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Hose Assembly, Polytetrafluoroethylene, Para Aramid Reinforced Heavy-Duty, 21 000 kPa, 135 °C, Aircraft Hydraulic Systems, Metric

1. SCOPE:

This document defines the requirements for heavy-duty hose assemblies suitable for use in 21 000 kPa, 135 °C aircraft systems where rapid rate pressure pulsing and torsional/longitudinal flexing may occur in addition to normal hydraulic system loading.

2. APPLICABLE DOCUMENTS:

2.1 Applicable Documents:

The following publications form a part of this specification to the extent specified herein. The applicable issue of documents shall be the issue in effect on the date of the purchase order.

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 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, 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 or Welded, Corrosion and Heat-Resistant, 18Cr - 11Ni (SAE 30321) 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 - 10.5Ni - 0.70(Cb+Ta) Solution Heat Treated

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2.1.1 (Continued):

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 5636	Steel Bars, Corrosion-Resistant, 18Cr - 8.5Ni (SAE 30302) Cold Drawn, 100,000 psi (690 MPa)
AMS 5637	Steel Bars, Corrosion-Resistant, 18Cr - 10Ni (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) - 3.5Cu Consumable Electrode Melted
ARP603	Impulse Testing of Hydraulic Hose Assemblies, Tubing and Fittings
AS611	Polytetrafluoroethylene 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 Systems
AS1072	Sleeve, Hose Assembly, Fire Protection
AS1073	Sleeve, Hose Assembly, Heat Shrinkable
AIR1228	Standard Impulse Machine Equipment and Operation
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft
MA1370	Screw Threads - MJ Profile, Metric
ARP1835	Preparation for Delivery, General Requirements for Hose Assemblies
MA2002	Impulse Testing of Hydraulic Hose, Tubing, and Fitting Assemblies
MA2014	Fitting End, Flareless Acorn, Metric
MA2078	Test Methods, Hose Assemblies
MA2095	Fitting Design Standard, 24° Cone, Dimensions for
MA2096	Fitting End, 24° Cone, Bulkhead, Standard Dimensions for
MA2273	Beam Seal, Male, Design Standard, Metric
MA2274	Beam Seal, Male, Bulkhead Design, Standard, Metric
AS4265	Impulse Testing of Hydraulic Tubing and Fittings, S-N Curve
AS4488	Tubular Assemblies, Fusion Welded, Inspection Processes and Acceptance Standards for
MA4624	Hose Assembly, Polytetrafluoroethylene, Para Aramid Reinforced, Heavy Duty, 21 000 kPa, 135 °C, Flareless, Titanium Fittings, St-St
MA4625	Hose Assembly, Polytetrafluoroethylene, Para Aramid Reinforced, Heavy Duty, 21 000 kPa, 135 °C, Flareless, Titanium Fittings, St-45°

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2.1.1 (Continued):

MA4626	Hose Assembly, Polytetrafluoroethylene, Para Aramid Reinforced, Heavy Duty, 21 000 kPa, 135 °C, Flareless, Titanium Fittings, St-90°
MA4627	Hose Assembly, Polytetrafluoroethylene, Para Aramid Reinforced, Heavy Duty, 21 000 kPa, 135 °C, Flareless, Titanium Fittings, 45°-45°
MA4628	Hose Assembly, Polytetrafluoroethylene, Para Aramid Reinforced, Heavy Duty, 21 000 kPa, 135 °C, Flareless, Titanium Fittings, 90°-90°
MA4629	Hose Assembly, Polytetrafluoroethylene, Para Aramid Reinforced, Heavy Duty, 21 000 kPa, 135 °C, Flareless, Titanium Fittings, 45°-90°

2.1.2 U.S. Government Publications: Available from Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.

QQ-P-35	Passivation Treatment for Corrosion Resistant Steel
QQ-S-763	Steel Bars, Wire Shapes, and Forgings, Corrosion-Resisting
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-8505	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-T-46010	Lubricant, Solid Film, Heat Cured, Corrosion Inhibiting
MIL-H-83282	Hydraulic Fluid, Fire-Resistant, Synthetic, Hydrocarbon Base, Aircraft
MIL-F-85421	Fittings, Tube, Fluid Systems, Separable, Dynamic Beam Seal, Requirements for
MIL-STD-100	Engineering Drawing Practices for Inspection
MIL-STD-105	Sampling Procedures and Tables by Attributes
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-831	Test Reports, Preparation of
MS19059	Balls, Bearing, Ferrous, Chrome Alloy Steel

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

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

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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 MA4624 through MA4629).

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 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:

3.2.1.1 Bars and Forgings:

QQ-S-763	Class 302 - Cond. A or Cond. B (AMS 5636 and AMS 5637)
QQ-S-763	Class 304 - Cond. A or 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
ASTM B 348	Grade 2 - Titanium Alloy

3.2.1.2 Tubing:

MIL-T-8504	Comp. 304 (AMS 5567)
MIL-T-8505	Type I, Comp. 321 (AMS 5570)
MIL-T-8808	Type I or Type II, Comp. 321 (AMS 5557, AMS 5570, or AMS 5576)
	Type I or Type II, Comp. 347 (AMS 5571, AMS 5575, or AMS 5556)
AMS 4945	Ti 3Al 2.5V Cold Worked and Stress Relieved

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.

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3.2.3 Finish:

3.2.3.1 Corrosion resistant steel (CRES), passivate per QQ-P-35.

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

3.3 Design and Fabrication:

The hose assembly shall consist of a seamless polytetrafluoroethylene inner tube, treated para aramid reinforcement, polyester braid or polybenzimidazol/para aramid blend braid cover 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 braided polyester or polybenzimidazol/para aramid blend braid cover. 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 cover braid shall provide 100% coverage to protect the para aramid reinforcement from exposure to ultraviolet light. A continuous lay line interrupted with MA4623 (or AS4623) and hose manufacturer's name or trademark shall be permanently marked in contrasting color along length of 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; flareless fittings in accordance with MA2014 to mate with MA2095 or MA2096; beam fittings to mate with male end fitting MA2273 and MA2274, in accordance with applicable documents. Antitorque hexes shall be provided and shall fit standard metric wrench openings. All internal surfaces of fitting nuts shall be dry filmed with dry film per MIL-L-46010 Type I. Dry film on external surfaces is optional.

3.3.3.1 Insert Fittings: Insert fittings shall be of one-piece construction. Welded 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 and titanium fittings may be classified per 3.3.3.2 for construction.

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3.3.3.2 Other Fittings: Other fittings including elbow fittings shall preferably be of one piece construction, if possible. However, those made with other than one piece construction shall use welded and redrawn tubing in accordance with MIL-T-8504 or MIL-T-8808 and shall employ a butt-weld joint method per AS4488. Titanium tubes shall be in accordance with AMS 4945 and employ a butt-weld joint method per MIL-STD-2219 or AS4488.

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) and 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 1.

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 covered in Table 2.

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 that would affect continued use of tube when rolled and tested to the applicable proof pressure values of MA2078 for 1 min. 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, that would affect continued use of tube when pressurized to the Table 3 applicable proof pressure values of MA2078 for 1 min. 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 15 200 kPa minimum at 25 °C ± 1 °C. The transverse tensile strength for DN size 16 and larger shall be 2500 kPa minimum at the same temperature. For DN size 12 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 at 25 °C ± 1 °C shall be a minimum of 200%. Test method is specified in 4.6.2.3.

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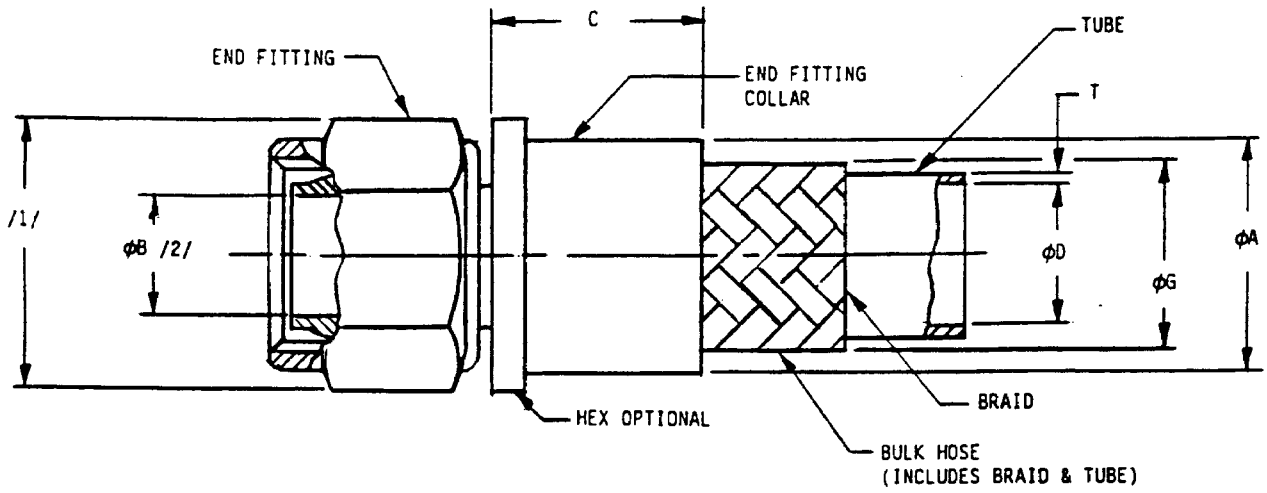

FIGURE 1 - Hose and Fitting Dimensions

TABLE 1 - Hose and Fitting Dimensions in mm

Hose Size DN	Fitting OD A Max	Fitting ID B /2/ Min	Socket Length C Max	Hose ID D Min	(Hose OD) E Min	(Hose OD) E Max	Unbraided PTFE Wall Thickness F Min
6	18	3.4	32	5.4	12.2	13.7	0.88
10	21	6.1	37	7.6	16.0	17.5	0.88
12	25	8.6	46	9.9	19.4	21.0	1.14
16	30	10.4	58	12.3	22.4	24.1	1.14
20	35	13.0	64	15.3	28.7	30.7	1.14
25	42	19.3	77	21.6	36.2	38.3	1.27
32	TBD	TBD	91	28.0	43.2	45.2	1.27

NOTES: (For Figure 1 and Table 1)

/1/ Cross corners of hex may exceed "A" dimension.
/2/ Minimum specified inside diameter shall be verified by passing the applicable MS19059 spherical ball through the hose assembly.

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TABLE 2 - Physical Requirements of Hose Assemblies and Weight of Hose

Hose Size DN	Hose Weight kg/m Max /1/	Operating Pressure kPa Max	Proof Pressure kPa Max	Burst Pressure Room Temp kPa Min	Burst Pressure High Temp kPa Min	Bend Radius Inside Bend Min in mm	Volumetric Expansion cc/cm Max
6	TBD	21 000	42 000	110 000	83 000	38	0.035
10	TBD	21 000	42 000	97 000	72 000	64	0.052
12	TBD	21 000	42 000	97 000	72 000	73	0.074
16	TBD	21 000	42 000	83 000	62 000	83	0.151
20	TBD	21 000	42 000	83 000	62 000	102	0.194
25	TBD	21 000	42 000	83 000	62 000	190	0.446
32	TBD	21 000	42 000	83 000	62 000	305	0.546

/1/ Hose weight shall be determined on a hose length of 53.34 cm/min.

TABLE 3 - Tube Roll Gap and Proof Pressure

Size DN	Flattening Gap-Max in	Rounding Gap-Max in	Proof Pressure psi
06	.281	.250	380
10	.281	.328	280
12	.328	.469	220
16	.328	.578	170
20	.328	.688	130
25	.328	.828	95
32	.538	1.000	95

3.5.1.5 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.

3.5.2 Hose Assembly: The reinforced hose 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. The test method is specified in 4.6.3.

3.5.2.2 Elongation and Contraction: The hose assembly shall not change in length by more than ±5.0 mm in 250 mm of hose length, when subjected to the maximum operating pressure of Table 2 for a minimum of 5 min. The test method is specified in 4.6.4.

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