

Issued	1983-07
Revised	1984-03
Reaffirmed	2007-08

Hose Assembly, Tetrafluoroethylene, Lightweight, 204 °C,
21 000 kPa Hydraulic, Metric

RATIONALE

This document has been reaffirmed to comply with the SAE 5-Year Review policy.

1. SCOPE:

This specification covers lightweight hose assemblies intended for use in high-temperature, 204 °C, high-pressure, 21 000 kPa (210 bar) aircraft hydraulic systems, also for use in pneumatic systems which allow some gaseous diffusion through the PTFE wall.

2. APPLICABLE DOCUMENTS:

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

2.1 Specifications:

2.1.1 Federal:

QQ-W-423	Wire, Steel, Corrosion-Resisting
P-D-680	Dry Cleaning Solvent
QQ-S-763	Steel Bars, Wire Shapes, and Forgings, Corrosion-Resisting
TT-I-735	Isopropyl Alcohol

2.1.2 Military:

MIL-C-5501	Caps and Plugs, Protective, Dust and Moisture Seal, General Specification for
MIL-F-8815	Filter and Filter Elements, Fluid Pressure, Hydraulic Lines, 15 Micron Absolute and 5 Micron Absolute, Type II Systems
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-H-8446	Hydraulic Fluid, Nonpetroleum Base, Aircraft
MIL-H-83282	Hydraulic Fluid, Fire-Resistant, Synthetic, Hydrocarbon Base, Aircraft

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be reaffirmed, revised, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2007 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE MA2007A

SAE MA2007 Revision A

2.1.2 (Continued):

MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-T-8504	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-T-27602	Trichloroethylene, Oxygen Propellant Compatibility

2.2 Standards:

2.2.1 Military:

DOD-STD-100	Engineering Drawing Practices
MIL-STD-105	Sampling Procedures and Tables for Inspection 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

Copies may be obtained from the procuring activity or as directed by the contracting officer.

2.3 Other Publications:

American Society for Testing and Materials:

ASTM A 262	Detecting Susceptibility to Intergranular Corrosion on Stainless Steel
ASTM D 412	Rubber, Determination of Tension Characteristics
ASTM D 571	Rubber Hose for Automotive Hydraulic Brake Systems
ASTM D 792	Specific Gravity and Density of Plastics by Displacement
ASTM D 1457	TFE - Fluorocarbon Resin Molding and Extrusion Materials

Copies may be obtained from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

Society of Automotive Engineers:

AMS 3380	Hose, Polytetrafluoroethylene, TFE Fluorocarbon Resin, Wire Braid Reinforced
AMS 5556	Steel Tubing, Seamless or Welded, Corrosion and Heat-Resistant 18 Cr - 11 Ni - (Cb + Ta) (SAE 30347) Hydraulic
AMS 5557	Steel Tubing, Seamless and Welded, Corrosion and Heat-Resistant 18 Cr - 11 Ni - Ti (SAE 30321) Hydraulic
AMS 5567	Steel Tubing, Seamless and Welded, Corrosion Resistant 19 Cr - 10 Ni (SAE 30304) Hydraulic, Solution Treated
AMS 5570	Steel Tubing, Seamless, Corrosion and Heat-Resistant 18.5 Cr - 10.5 Ni - 0.40 Ti (SAE 30321)
AMS 5571	Steel Tubing, Seamless, Corrosion and Heat-Resistant 18 Cr - 11 Ni - 0.70 (Cb + Ta) (SAE 30347)
AMS 5575	Steel Tubing, Welded, Corrosion and Heat-Resistant 18 Cr - 10.5 Ni - 0.70 (Cb + Ta) (SAE 30347)

SAE MA2007 Revision A

2.3 (Continued):

AMS 5639	Steel Bars, Forgings, Tubing and Rings, Corrosion-Resistant 19 Cr - 10 Ni (SAE 30304)
AMS 5643	Steel Bars, Forgings, Tubing and Rings, Corrosion Resistant 16.5 Cr - 4.0 Ni - 4.0 Cu
AMS 5644	Steel Bars and Forgings, Corrosion and Heat Resistant 17 Cr - 7 Ni - 1 Al
AMS 5645	Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant 18 Cr - 10 Ni - 0.40 Ti (SAE 30321)
AMS 5646	Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant 18 Cr - 11 Ni - 0.60 (Cb + Ta) (SAE 30347)
AMS 5689	Steel Wire, Corrosion and Heat Resistant 18 Cr - 9.5 Ni - Ti (SAE 30321) Solution Heat-Treated
AMS 5690	Steel Wire, Corrosion and Heat-Resistant 17 Cr - 12 Ni - 2.5 Mo (SAE 30316)
AMS 5697	Steel Wire, Corrosion-Resistant 19 Cr - 9.5 Ni (SAE 30304)
AMS 5743	Steel Bars and Forgings, Corrosion and Moderate Heat-Resistant 15.5 Cr - 4.5 Ni - 2.9 Mo - 0.10 N, Solution Heat-Treated, Subzero Cooled, Equalized, and Oven Tempered
ARP611	Tetrafluoroethylene Hose Assembly Cleaning Methods
ARP1153	Method for Determining Relative Specific Gravity, PTFE Tubing
ARP1835	Preparation for Delivery, General Requirements for Hose Assemblies
AS1055	Fire Resistance, Fire Test and Performance Requirements for Flexible Hose and Rigid Tube Assemblies
AS1072	Sleeve, Hose Assembly, Fire Protection
MA1370	Screw Threads, Controlled Radius Root with Increased Minor Diameter; General Specification for
MA2002	Impulse Testing of Hydraulic Hose Assemblies, Tubing and Fittings
MA2005	Tube Fittings, Fluid Systems, Separable, General Specification for
MA2011	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
MA2014	Fitting End, Flareless Acorn, Standard Dimensions for
MA2019	Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seal

Copies may be obtained from the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096-0001.

3. REQUIREMENTS:

3.1 Qualification:

The hose assemblies furnished under this specification shall be products which are qualified by meeting all the requirements covered by this document.

3.2 Material:

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. All materials not specifically described 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 applicable specifications as follows:

Bars and Forgings:

QQ-S-763	Class 304 - Condition A and Condition B (AMS 5639)
QQ-S-763	Class 321 - Condition A (AMS 5645)
QQ-S-763	Class 347 - Condition A (AMS 5646)
AMS 5643	17-4 PH
AMS 5644	17-7 PH
AMS 5743	AM-355

Tubing:

MIL-T-8504	Composition 304 (AMS 5567)
MIL-T-8808	Type I or Type II, Composition 321 (AMS 5570 or AMS 5557)
MIL-T-8808	Type I or Type II, Composition 347 (AMS 5571 or AMS 5575, AMS 5556)

Wire:

QQ-W-423	Composition 305 (AMS 5691)
QQ-W-423	Composition 304 (AMS 5697)
QQ-W-423	Composition 316 (AMS 5690)
AMS 5689	Composition 321 (QQ-W-423, Form 1, Composition 321)

3.3 Construction:

The hose assembly shall consist of a seamless tetrafluoroethylene inner tube, corrosion-resistant steel-wire reinforcement, and corrosion-resistant steel end fittings are required to meet the construction and performance requirements of this specification, and as required for its intended use.

- 3.3.1 Inner Tube: The inner tube shall be of a seamless construction of virgin tetrafluoroethylene 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 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.

SAE MA2007 Revision A

3.3.3 Fittings: All fittings shall be proven to meet the requirements herein. Standard hose assemblies shall have flared fittings to mate with MA2019 or flareless fittings according to MA2014 to mate with MA2011. Fitting hex portions shall fit standard wrench openings.

3.3.3.1 Insert Fittings: Standard insert fittings shall be of one piece construction. Welded and redrawn tubing per MIL-T-8504 or MIL-T-8808 may be used.

3.3.3.2 Nonstandard Fittings: Nonstandard fitting nipples shall be of one piece construction to the maximum extent possible. Those made with other than one piece construction can use welded and redrawn tubing per MIL-T-8808 and shall employ a butt-weld joint method.

3.3.3.3 Crimped or swaged sockets of 304 steel shall pass testing per ASTM A 262 practice E prior to crimping or swaging.

NOTE: This requirement does not apply to sockets of 321, 347 or 304L corrosion resistant steel.

3.4 Dimensions:

The hose assembly dimensions, except for length, shall be as specified in Figure 6 and Table 6.

3.4.1 Hose Weight: Hose consisting of inner tube and reinforcement as outlined in 3.3.1 through 3.3.3 shall not exceed the maximum hose weights covered in Table 1.

TABLE 1 - Physical Requirements of Hose Assemblies and Weight of Hose

Hose Size	/1/ Hose Weight Maximum	Operating Pressure	Proof Pressure	Burst Pressure		Bend Radius at Inside of Bend Minimum	Volumetric Expansion Minimum
				Room Temperature Minimum	High Temperature Minimum		
	kg/m	kPa	kPa	kPa	kPa	mm	cm ³ /m
DN06	.16	21 000	42 000	110 000	82 700	38	2.6
DN10	.27	21 000	42 000	96 000	72 400	63	3.3
DN12	.36	21 000	42 000	96 000	72 400	73	5.3
DN16	.48	21 000	42 000	84 000	62 000	82	6.7
DN20	.82	21 000	42 000	84 000	62 000	101	11.8
DN25	1.52	21 000	42 000	84 000	62 000	127	29.5

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

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 tested through the sequence as specified in 4.6.2.1.

SAE MA2007 Revision A

- 3.5.1.2 Tube Proof Pressure: The tube, without reinforcing wires, shall not leak, burst or show any evidence of malfunction when held for one (1) minute at the proof pressure values as specified in Table 4 and under 4.6.2.1.
- 3.5.1.3 Tensile Strength: The longitudinal tensile strength for all sizes of tubes shall be 15 100 kPa minimum at $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ when tested in accordance with 4.6.2.2. The transverse tensile strength for sizes DN16 and larger shall be 12 400 kPa minimum at the same temperature. For sizes under DN16, the transverse strength need not be tested.
- 3.5.1.4 Elongation: Elongation at $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ shall be a minimum of 200 percent 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 2.210 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 requirement.
- 3.5.2.1 Proof Pressure: The hose assembly shall withstand the proof pressure listed in Table 1 without malfunction or leakage, when tested as specified in 4.6.3.
- 3.5.2.2 Elongation and Contraction: The hose assembly shall not change in length by more than 2% of hose length, when subjected to the operating pressure in Table 1 for a minimum of 5 minutes. Hose assemblies shall be tested in accordance with 4.6.4.
- 3.5.2.3 Volumetric Expansion: The volumetric expansion of the hose assemblies, when tested in accordance with 4.6.5, shall not exceed the limits specified in Table 1.
- 3.5.2.4 Leakage: The hose assembly shall not leak when subjected to two (2) pressure cycles of 70 percent of minimum room temperature burst pressure, when tested in accordance with 4.6.6.
- 3.5.2.5 Room Temperature Burst Pressure: The hose assembly shall not leak nor burst at any pressure below the burst value specified in Table 1, when tested in accordance with 4.6.7.
- 3.5.2.6 Thermal Shock: The hose assemblies shall not leak nor show any evidence of malfunction when pressure tested from $-54\text{ }^{\circ}\text{C}$ to $204\text{ }^{\circ}\text{C}$ as specified in 4.6.8.
- 3.5.2.7 Impulse: The hose assemblies shall be capable of withstanding 250,000 impulse cycles when tested in accordance with 4.6.9.
- 3.5.2.8 Assembly Flexibility: The hose assembly shall not leak when flex cycle tested from $-54\text{ }^{\circ}\text{C}$ to $204\text{ }^{\circ}\text{C}$ as specified in 4.6.10. Any leakage from the hose or fittings, hose burst, fitting blow-off, or any other evidence of malfunction during the test shall constitute failure.
- 3.5.2.9 Stress Degradation: When tested in accordance with 4.6.11, the hose assembly shall not exceed an average effusion rate of $78\text{ cm}^3/\text{m}/\text{min}$ for any size.

SAE MA2007 Revision A

- 3.5.2.10 Pneumatic Surge: The inner tube of the hose assembly shall not collapse nor show evidence of degradation when tested in accordance with 4.6.12.
- 3.5.2.11 Pneumatic Effusion: The hose assemblies, when tested in accordance with 4.6.13, shall not exceed a total effusion rate of 26 cm³/m of hose for any size.
- 3.5.2.12 Repeated Assembly: The fitting shall withstand, without leakage or failure, the repeated assembly test as described under 4.6.14. There shall be no leakage, galling or other malfunction in proof testing, or pneumatic testing after the last assembly cycle.
- 3.5.2.13 Conductivity: When tested as specified in 4.6.15, hose assemblies of sizes DN06 through DN12 shall be capable of conducting a direct current equal to or greater than six (6) microamperes, and sizes DN16 through DN25 a current equal to or greater than twelve (12) microamperes, with a test potential of 1000 volts, direct current.

3.6 Screw Threads:

Fitting threads shall be in accordance with AS1370. Fitting nut thread tolerance increase of 10 percent during assembly or testing shall not be cause for rejection of the hose assembly.

3.7 Length:

Hose assembly length shall be specified in the following increments only:

Under 500 mm, not less than 5 mm
500-1000 mm, not less than 10 mm
1000-1500 mm, not less than 20 mm
Over 1500 mm, not less than 30 mm

NOTE: Flareless hose assembly lengths shall be measured from "gage point" to "gage point."

Tolerances on hose assembly lengths shall be as follows:

±3 mm for lengths under 500 mm
±7 mm for lengths from 500 to 900 mm
±13 mm for lengths from 900 to 1300 mm
±1% for lengths over 1300 mm

3.8 Part Numbering of Interchangeable Parts:

All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The item identification and part number requirement of DOD-STD-100 shall govern the manufacturer's part numbers and changes thereto.