SAE LAND SEA AIR SPACE

AEROSPACE STANDARD

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AS 1339
Superseding ARP 1339

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HOSE ASSEMBLY, TETRAFLUOROETHYLENE, LIGHTWEIGHT HIGH TEMPERATURE HIGH PRESSURE 3,000 PSI (20 684 KPa), HYDRAULIC AND PNEUMATIC

1. SCOPE

This specification covers lightweight hose assemblies suitable for use in high-temperature, 400°F (204°C), high-pressure, 3000 psi (20 684 KPa), aircraft and missile hydraulic and pneumatic systems.

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

PPP-T-60	Tape, Packaging, Waterproof
QQ-W-423	Wire, Steel, Corrosion-Resisting
PPP-B-566	Boxes, Folding, Paperboard
PPP-B-576	Box, Wood, Cleated, Veneer, Paper Overlaid
PPP-B-585	Boxes, Wood, Wirebound
PPP-B-591	Boxes, Shipping Fiberboard, Wood-Cleated
PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-636	Boxes, Shipping, Fiberboard
PPP-B-665	Boxes, Paperboard, Metal-Edged and Components
PPP-B-676	Boxes, Set-Up
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-P-116	Preservation - Packaging, Methods of
MIL-C-5501	Caps and Plugs, Protective, Dust and Moisture Seal, General Specification for
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-H-8446	Hydraulic Fluid, Nonpetroleum Base, Aircraft
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-F-8815	Filter and Filter Elements, Fluid Pressure, Hydraulic Line, 15 Micron Absolute and 5 Micron Absolute, Type II Systems
MIL-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter; General Specification of
MIL-L-10547	Liners, Case and Sheet, Overwrap; Water-Vaporproof or Waterproof, Flexible
MIL-T-27602	Trichloroethylene, Oxygen Propellant Compatibility
MIL-H-83282	Hydraulic Fluid, Fire-Resistant, Synthetic, Hydrocarbon Base, Aircraft

2.2 STANDARDS

2.2.1 Military

MIL-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
MS21900	Adapter, Flareless Tube to AN Flared Tube
MS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
MS33656	Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seal

(Copies of documents required by suppliers in connection with specific procurement functions shall be obtained from the procuring activity or as directed by the Contracting Officer)

NOTE: This document supersedes and cancels ARP 1339.

2.3 Other Publications

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

Uniform Classification Committee

Uniform Freight Classification Rules

(Application for copies of the above publication should be addressed to the Uniform Classification Committee, 202 Chicago Union Station, Chicago, IL 60606)

American Society for Testing and Materials

D412 Rubber, Determination of Tension Characteristics
D571 Rubber Hose for Automotive Hydraulic Brake Systems
D792 Specific Gravity and Density of Plastics by Displacement
D1457 TFE - Fluorocarbon Resin Molding and Extrusion Materials

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103)

Society of Automotive Engineers

AMS3380 Hose, Polytetrafluoroethylene, TFE Fluorocarbon Resin, Wire Braid Reinforced
AMS5556 Steel Tubing, Seamless or Welded, Corrosion and Heat-Resistant 18 Cr - 11 Ni - (Cb + Ta) (SAE 30347) Hydraulic
AMS5557 Steel Tubing, Seamless and Welded, Corrosion and Heat-Resistant 18 Cr - 11 Ni - Ti (SAE 30321) Hydraulic
AMS5567 Steel Tubing, Seamless and Welded, Corrosion Resistant 19 Cr - 10 Ni (SAE 30304) Hydraulic, Solution Treated
AMS5570 Steel Tubing, Seamless, Corrosion and Heat-Resistant 18.5 Cr - 11 Ni - 0.40 Ti (SAE 30321)
AMS5571 Steel Tubing, Seamless, Corrosion and Heat-Resistant 18 Cr - 11 Ni - 0.70 (Cb + Ta) (SAE 30347)
AMS5575 Steel Tubing, Welded, Corrosion and Heat-Resistant 18 Cr - 10.5 Ni - 0.70 (Cb + Ta) (SAE 30347)
AMS5636 Steel Bars, Corrosion-Resistant 18 Cr - 8.5 Ni (SAE 30302) Cold Drawn, 100,000 psi (690 MN/m^2)
AMS5637 Steel Bars, Corrosion-Resistant 18 Cr - 8.5 Ni (SAE 30302), Cold Drawn, 125,000 psi (862 MN/m^2)
AMS5639 Steel Bars, Forgings, Tubing, and Rings, Corrosion-Resistant 19 Cr - 10 Ni (SAE 30304)
AMS5643 Steel Bars, Forgings, Tubing and Rings, Corrosion Resistant 16.5 Cr - 4.0 Ni - 4.0 Cu
AMS5644 Steel, Bars and Forgings, Corrosion and Heat Resistant 17 Cr - 7 Ni - 1Al
AMS5645 Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant 18 Cr - 10 Ni - 0.40 Ti (SAE 30321)
AMS5646 Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant 18 Cr - 11 Ni - 0.60 (Cb + Ta) (SAE 30347)
AMS5688 Steel Wire, Corrosion-Resistant 18 Cr - 9.0 Ni (SAE 30302) Spring Temper
AMS5689 Steel Wire, Corrosion and Heat Resistant 18 Cr - 9.5 Ni - Ti (SAE 30321) Solution Heat-Treated
AMS5690 Steel Wire, Corrosion and Heat-Resistant 18.5 Cr - 13 Ni - 2.5 Mo (SAE 30316)
AMS5697 Steel Wire, Corrosion-Resistant 19 Cr - 9.5 Ni (SAE 30304)
AMS5743 Steel Bars and Forgings, Corrosion and Moderate Heat-Resistant 15.5 Cr - 4.5 Ni - 2.9 Mo - 0.10 N, Solution Heat-Treated, Sub-zero Cooled, Equalized, and Over-Tempered

ARP 603 Impulse Testing of Hydraulic Hose Assemblies, Tubing and Fittings
ARP 611 Tetrafluoroethylene Hose Assembly Cleaning Methods
ARP 908 Hose Fitting - Installation and Qualification Test Torque Requirements
ARP 1153 Method for Determining Relative Specific Gravity, Polytetrafluoroethylene Tubing
AIR 1228 Standard Impulse Machine Equipment and Operation

AS115 Hose Assembly, Nonmetallic - 3000 psi, TFE, Flareless, Straight to Straight, Lightweight
AS116 Hose Assembly, Nonmetallic - 3000 psi, TFE, Flareless, Straight to 45°, Lightweight
AS117 Hose Assembly, Nonmetallic - 3000 psi, TFE, Flareless, Straight to 90°, Lightweight
AS118 Hose Assembly, Nonmetallic - 3000 psi, TFE, Flareless, 45° to 45°, Lightweight

AS1119	Hose Assembly, Nonmetallic - 3000 psi, TFE, Flareless, 45° to 90°, Lightweight
AS1120	Hose Assembly, Nonmetallic - 3000 psi, TFE, Flareless, 90° to 90°, Lightweight
AS153	Hose Assembly, Nonmetallic - 3000 psi, TFE, Flared, Straight to Straight, Lightweight
AS154	Hose Assembly, Nonmetallic - 3000 psi, TFE, Flared, Straight to 45°, Lightweight
AS155	Hose Assembly, Nonmetallic - 3000 psi, TFE, Flared, Straight to 90°, Lightweight
AS156	Hose Assembly, Nonmetallic - 3000 psi, TFE, Flared, 45° to 45°, Lightweight
AS157	Hose Assembly, Nonmetallic - 3000 psi, TFE, Flared, 45° to 90°, Lightweight
AS158	Hose Assembly, Nonmetallic - 3000 psi, TFE, Flared, 90° to 90°, Lightweight
AS1055	Fire Resistance, Fire Test and Performance Requirements for Flexible Hose and Rigid Tube Assemblies
AS1072	Sleeve, Hose Assembly, Fire Protection

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

National Aerospace Standards

NAS1760	Fitting End, Flareless Acorn, Standard Dimensions for

(Application for copies should be addressed to National Aerospace Standards Committee, 1725 DeSales Street, N.W., Washington, DC 20036)

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 following specifications:

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 321 - Cond. A (AMS 5645)
QQ-S-763	Class 347 - Cond. A (AMS 5646)
AMS 5643	17-4 PH
AMS 5644	17-7 PH
ø AMS 5743	AM-355

Tubing

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

Wire

QQ-W-423	Comp. 302 (AMS 5688)
QQ-W-423	Comp. 304 (AMS 5697)
QQ-W-423	Comp. 316 (AMS 5690)
AMS 5689	Comp. 321 (QQ-W-423, Form 1, Comp. 321)

3.3 CONSTRUCTION

ø The hose assembly shall consist of a seamless tetrafluoroethylene inner tube, corrosion-resistant steel-wire reinforcement, and corrosion-resistant steel end fittings as required for the intended installation.

3.3.1 Inner Tube

The inner tube shall be of a seamless construction of virgin tetrafluoroethylene resin of uniform gauge. 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

ø 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

ø 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 of withstanding temperatures of -65°F (-54°C) to 400°F (204°C) and shall not extrude through the outer braid during testing or in service.

3.3.4 Fittings

ø All fittings shall be proven to meet the requirements herein. Standard hose assemblies shall have flared fittings to mate with MS33656 or flareless fittings according to NAS 1760 to mate with MS33514 in accordance with applicable SAE Standards (see 2.2). Fitting hex portions shall fit standard wrench openings.

3.3.4.1 Insert Fittings

ø 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.

3.3.4.2 Non-Standard Fittings

ø Non-standard elbow nipples shall be of one piece construction to the maximum extent possible. However, those made with other than one piece construction can use welded and redrawn tubing per MIL-T-8504 or MIL-T-8808 and shall employ a butt-weld joint method.

3.4 DIMENSIONS

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

3.4.1 Hose Weight

Hose consisting of inner tube, reinforcement and interlayers as outlined in paragraphs 3.3.1 through 3.3.3 shall not exceed the maximum hose weights covered in Table I.

ø

TABLE I

PHYSICAL REQUIREMENTS OF HOSE ASSEMBLIES AND WEIGHT OF HOSE

Hose Size	Hose Weight Max. [1]		Operating Pressure Max.		Proof Pressure Min.		Burst Pressure				Bend Radius At Inside of Bend Min.		Volumetric Expansion Max.	
							Room Temperature Min.		High Temperature Min.					
	Lbs/In	Kg/M	PSI	KPa	PSI	KPa	PSI	KPa	PSI	KPa	In.	MM.	CC/In	CC/CM
-4	.010	.18	3,000	20 684	6,000	41 369	16,000	110 316	12,000	82 737	1.50	38.1	.065	.026
-6	.015	.27	3,000	20 684	6,000	41 369	14,000	96 527	10,500	72 395	2.50	63.5	.085	.033
-8	.021	.38	3,000	20 684	6,000	41 369	14,000	96 527	10,500	72 395	2.88	73.2	.135	.053
-10	.027	.48	3,000	20 684	6,000	41 369	12,000	82 737	9,000	62 053	3.25	82.6	.220	.087
-12	.056	1.00	3,000	20 684	6,000	41 369	12,000	82 737	9,000	62 053	4.00	101.6	.300	.118
-16	.085	1.52	3,000	20 684	6,000	41 369	12,000	82 737	9,000	62 053	5.00	127.0	.750	.295

[1] Hose Weight shall be determined on a minimum length of 12 inches (305 mm)

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

ø The tube shall not leak, split, burst, or show any evidence of malfunction, when rolled through the sequence as specified in 4.6.2.1.

3.5.1.2 Tube Proof Pressure

The tube, without reinforcing wires, shall not leak, burst or show any evidence of malfunction when held at the proof pressure specified in Table IV for one (1) minute.

3.5.1.3 Tensile Strength

ø The longitudinal tensile strength for all sizes of tubes shall be 2,200 psi (15 168 KPa) minimum at 77°F ±2°F (25°C ±1°C) when tested in accordance with 4.6.2.2. The transverse tensile strength for sizes -10 and larger shall be 1,8000 psi (12 411 KPa) minimum at the same temperature. For sizes under -10, the transverse tensile strength need not be tested.

3.5.1.4 Elongation

ø Elongation at 77°F ±2°F (25°C ±1°C) shall be a minimum of 200 percent when tested in accordance with 4.6.2.3.

3.5.1.5 Specific Gravity

ø The hose inner tube shall conform to the specific gravity values as required herein, 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

ø The hose assembly shall withstand the proof pressure listed in Table I without malfunction or leakage, when tested as specified in 4.6.3.

3.5.2.2 Elongation and Contraction

ø The hose assembly shall not change in length by more than ±0.20 inch (±5.1 mm) in 10 inches (254 mm) of hose length, when subjected to the operating pressure in Table I for minimum of 5 minutes. Hose assemblies shall be tested in accordance with 4.6.4.

3.5.2.3 Volumetric Expansion

ø The volumetric expansion of the hose assemblies, when tested in accordance with 4.6.5, shall not exceed the limits specified in Table I.

3.5.2.4 Leakage

ø 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

ø The hose assembly shall not leak nor burst at any pressure below the burst value specified in Table I, when tested in accordance with 4.6.7.

3.5.2.6 Thermal Shock

ø The hose assemblies shall not leak nor show any evidence of malfunction when pressure tested from -67°F (-54°C) to 400°F (204°C) as specified in 4.6.8.

3.5.2.7 Impulse

ø 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

ø The hose assembly shall not leak nor show any evidence of malfunction when flex cycle tested from -67°F (-54°C) to 400°F (204°C) as specified in 4.6.10.

3.5.2.9 Stress Degradation

ø The hose assembly shall not exceed the air leakage as specified when tested in accordance with 4.6.11.

3.5.2.10 Pneumatic Surge

ø 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 Effusion

ø The hose assemblies, when tested in accordance with 4.6.13, shall not exceed the effusion rates specified herein.

3.5.2.12 Overtightening Torque

ø The fitting shall withstand the overtightening torque values specified in ARP 908 when tested in accordance with 4.6.14.

3.5.2.13 Conductivity

ø When tested as specified in 4.6.15, hose assemblies of sizes -4 through -8 shall be capable of conducting a direct current equal to or greater than six (6) microamperes, and sizes -10 through -16, a current equal to or greater than twelve (12) microamperes, with a test potential of 1,000 volts dc.

3.6 SCREW THREADS

Coupling nut threads shall be in accordance with MIL-S-8879. Thread tolerance increase of 10% 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 18 inches (457 mm), not less than 1/8 inch (3.2 mm)
18 to 36 inches (457 to 914 mm), not less than 1/4 inch (6.4 mm)
36 to 50 inches (914 to 1 270 mm), not less than 1/2 inch (12.7 mm)
Over 50 inches (1 270 mm), not less than 1 inch (25.4 mm)

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

Tolerances on hose assembly lengths shall be as follows:

±1/8 inch (3.2 mm) for lengths under 18 inches (457 mm)
±1/4 inch (6.4 mm) for lengths from 18 to 36 inches (457 to 914 mm)
±1/2 inch (12.7 mm) for lengths from 36 to 50 inches (914 to 1 270 mm)
±1% for lengths over 50 inches (1 270 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 MIL-STD-100 shall govern the manufacturer's part numbers and changes thereto.

3.9 IDENTIFICATION OF PRODUCT

Equipment, assemblies and parts shall be marked for identification in accordance with MIL-STD-130. The following special marking shall be added:

3.9.1 Fittings

The manufacturer's name or trademark shall be permanently marked on all end fittings.

3.9.2 Assembly

A permanent marking on the fitting or a permanent band on the hose shall be used. The band shall be no wider than one inch (25 mm) and shall not impair the flexibility or the performance of the hose. The marking on the fitting or band shall include the following
ø information:

a. Assembly manufacturer's name or trademark, and assembly specification "AS 1339."

b. Complete hose assembly part number.

c. Operating pressure "3000 psi" or "20 684 KPa," as applicable.

d. Operating temperature "400°F" or "204°C," as applicable.

e. Pressure test symbol "PT."

f. Date of hose assembly manufacture expressed in terms of month and year.

g. Hose manufacturer's federal code number (Handbook H4-1).

3.10 WORKMANSHIP

ø The hose assembly, including all parts, shall be constructed and finished in a thoroughly workmanlike manner. All surfaces shall be free from burrs. All sealing surfaces shall be smooth, except that annular tool marks up to 100 microinches (2.5 micrometers) rms maximum will be acceptable.

3.10.1 Dimensions and Tolerances

All pertinent dimensions and tolerances, where interchangeability, operation or performance of the hose assembly may be affected, shall be specified on all drawings.

3.10.2 Cleaning

ø All hose assemblies shall be free from oil, grease, dirt or other foreign materials both, internally and externally. Unless otherwise specified, hose assemblies shall be cleaned to Class 0 of ARP 611.

4. QUALITY ASSURANCE PROVISIONS

4.1 RESPONSIBILITY FOR INSPECTION

ø Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the procuring activity. The procuring activity reserves the right to perform any of the inspections set forth in the specification, where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 CLASSIFICATION OF INSPECTIONS

The examining and testing of hose assemblies shall be classified as:

a. Qualification inspections (4.3).

b. Quality conformance inspections (4.4).

ø 4.3 QUALIFICATION INSPECTIONS

4.3.1 Qualification Test Samples

Test samples shall consist of the number of samples and lengths specified in Table II for each method of fitting attachment (permanent and reusable). The procedure used shall be as specified in Table III. The end fitting outlet design for the samples shall have flared fittings to mate with MS33656 or flareless fittings according to NAS 1760 to mate with MS33514.

TABLE II

LENGTH OF HOSE ASSEMBLIES FOR TEST (IN INCHES)

ø

Hose Assembly Size	Six Assemblies for Impulse Test (4.6.9)	Two Assemblies for Flex Test (4.6.10)	Six Assemblies for Other Tests 2
-4	12	16	18
-6	15	19	18
-8	18	21	18
-10	21	23	18
-12	25	27	18
-16	31	32	18

2 One additional sample of each size in lengths as shown in Figure 5 shall be used for examination and conductivity tests (sample No. 20 of Table III).

TABLE III

QUALIFICATION TEST SCHEDULE

Sample No.	Tube 1 (4)	Ftgs. 2 thru 5	Assemblies 6	7	8	9	10	11	12	13	14-19 (3)	20
Paragraph 4.6 -	.1 .2	.1 .14	.1 .2 .3 .4 .10	.1 .2 .3 .4 .10	.1 .2 .3 .5 .13 .7	.1 .2 .3 .5 .13 .7	.1 .2 .3 .6 .8	.1 .2 .3 .6 .8	.1 .2 .3 .11 .12	.1 .2 .3 .11 .12	.1 .2 .3 .9	.1 .15

All assemblies to contain flared fitting on one end and flareless on the other, except (3).

(3) These samples shall have a 90° elbow fitting on one end of the hose, and a straight-type fitting on the other end of the hose. If approval is being sought for both the bent-tube and the forged-elbow configuration, then one-half of the samples (3) shall use one type of configurated elbow, while the other half of the samples use the other type.

(4) Production lot records may be used to verify conformance to 4.6.1 and 4.6.2 when the tube being used is an established production item.

4.3.2 Test Report, Test Samples and Data for the Procuring Activity.

When the tests are conducted at a location other than the laboratory of the procuring activity, the following shall be furnished to that activity:

a. Test report. Three (3) copies of a test report in accordance with MIL-STD-831, which shall include a report of all tests and outline description of the tests and conditions.

b. Test Sample. The sample which was tested, when requested by the procuring activity.

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c. Three (3) sets of engineering data in the form of detail and assembly drawings. The assembly drawings shall have a cut-away section showing all details in their normal assembly position and shall carry part numbers of all details and subassemblies.

d. List of sources of hose or hose components, including source's name and product identification for inner tube, hose and assembly.

NOTE: Log sheets, containing required test data, shall remain on file at the source test facility and are not to be sent to the qualifying activity unless specifically requested.

4.3.3 Qualification Inspections

Qualification inspections shall consist of all the examinations and tests specified under 4.6.

4.4 QUALITY CONFORMANCE INSPECTIONS

Quality conformance inspections shall be sampled in accordance with the procedure in MIL-STD-105 and shall consist of the following tests:

a. Individual tests - 4.4.1 (100 percent inspection)

b. Sampling tests - 4.4.2

c. Periodic control tests - 4.4.3

4.4.1 Individual Tests

Each hose assembly shall be subjected to the following tests:

a. Examination of product - 4.6.1

ø

b. Proof pressure test - 4.6.3

NOTE: Production samples that are proof pressure tested with water should be air dryed prior to capping (see cleaning requirements, paragraph 3.10.2).

4.4.2 Sampling Tests

Ø The following tests shall be performed on the three (3) hose assemblies, individually selected at random from each completed lot. A sample lot shall consist of no more than 3,000 hose assemblies, all of one (1) dash size, manufactured under essentially the same conditions.

4.4.2.1 The hose assemblies shall be subjected to the following tests in the order as indicated:

a. Elongation and contraction - 4.6.4

b. Leakage test - 4.6.6

c. Room-temperature burst pressure test - 4.6.7

d. Specific gravity tests - 4.6.2.4 (Apparent and Relative)

4.4.3 Periodic Control Tests

The following tests shall be performed on six (6) assemblies, individually selected at random from each complete lot. A periodic control test lot shall consist of no more than 9,000 hose assemblies, all of one (1) dash size, manufactured under essentially the same conditions.

Ø

a. Impulse test - 4.6.9 (3 unaged samples)

b. Stress degradation test - 4.6.11 (2 samples)

c. Conductivity test - 4.6.15 (one sample)

4.4.4 Rejection and Retest

Where one or more items selected from a lot fails to meet the specification, all items in the lot shall be rejected.

4.4.4.1 Resubmitted Lots

Ø Once a lot (or part of a lot) has been rejected by a procuring activity (Government or industrial), before it can be resubmitted for tests, full particulars concerning the cause of previous rejection and the action taken to correct the defects in the lot shall be furnished, in writing, by the contractor.

4.4.5 Switching Procedures

Switching inspection severity levels (for example, from normal to tightened inspection) shall be in accordance with MIL-STD-105. All inspection plans shall be single sample plans with an AQL of 1.0 percent at special inspection level S-2.

4.4.6 Destructive Test Sample

Prior to testing, a letter "D" shall be impression-stamped on each end fitting of those assemblies used for destructive tests (4.4.2 and 4.4.3).

4.5 TEST CONDITIONS

4.5.1 Fitting Ends

Ø Qualification tests shall be conducted on assemblies using straight type swivel ends (flared on one end, flareless on the other), except the samples 14 through 19 shall have a 90° elbow fitting on one end. Satisfactory qualification tests on these hose assemblies shall constitute qualification approval on hose assemblies using other fittings that have an identical hose attachment method and design.

Ø 4.5.2 Preparation of Sample

4.5.2.1 Unless otherwise specified, length of sample assemblies shall be in accordance with Table II.

4.5.2.2 The test hose assemblies may be made up with one end having a flared fitting to mate with parts in accordance with MS33656, and the other end having a flareless fitting in accordance with NAS 1760 to mate with parts in accordance with MS33514. However, if the test samples are all flared type end fittings, and qualification approval is desired also

for flareless style fittings, the following procedures are required: Two (2) additional assemblies having flareless style fitting ends of the size to be qualified shall be subjected to the following tests:

a. Examination of product - 4.6.1

b. Proof pressure test - 4.6.3

c. Leakage test - 4.6.6

d. Room temperature burst pressure test - 4.6.7

e. Overtightening torque test - 4.6.14

4.5.2.3 Oil Aging

In all the tests using oil aged samples, the hose assemblies shall be filled with a high temperature test fluid and soaked in an air oven at a temperature of 400°F (204°C) for seven (7) days. All air shall be excluded from the bore of the assembly during the test. No pressure shall be applied to the assembly during the aging period.

4.5.2.4 Air Aging

Air aged samples shall be kept in air at a temperature of 400°F (204°C) for seven days.

4.5.2.5 Unaged Samples

Unaged assemblies shall be as shipped from the hose assembly manufacturer.

4.5.3 Test Fluids

Unless otherwise specified, the pressure test fluid shall be hydraulic oil conforming to MIL-H-5606, or water. Where a high temperature test fluid is specified, the test fluid shall be MIL-H-8446 hydraulic fluid, MIL-L-7808 lubricating oil, or one of the following:

a. General Electric F-50 or equal

b. Dow Chemical F-60 or equal

c. Oronite Chemical 8200 or equal

d. MIL-H-83282 or equal

Unless otherwise specified, all pressures shall have a tolerance of ±100 psi (±689 KPa).

4.5.4 Temperature Measurements

Unless otherwise specified, temperature measurements shall be taken within 6 inches (152 mm) of the hose assemblies under test. Unless otherwise specified, all temperatures shall have a tolerance of +15°F (+8°C), -5°F (-3°C).

4.5.5 End Connections

Except as otherwise noted, each hose end shall be connected to a steel male fitting end in accordance with MS33656 or MS33514, lubricated with either MIL-H-5606 fluid or the test fluid, with the installation torque range specified in ARP 908.

4.6 INSPECTION METHODS

4.6.1 Examination of Product

Each length of tubing shall be examined to determine conformance to this specification with respect to material, size, workmanship and dimensions.

4.6.1.1 All hose assemblies shall be visually inspected to determine conformance to this specification and inspected for broken or missing reinforcing wires or any evidence of malfunction which shall be cause for rejection. Crossed over reinforcing wires shall not be cause for rejection.

4.6.2 Tube Tests

4.6.2.1 Tube Roll and Proof Pressure Test

Each length of tubing shall be subjected to a tube roll and proof pressure test in accordance with AMS 3380, except that the flattening gap, rounding gap, and proof pressure shall be as specified in Table IV. The test fluid shall be air or water.

TABLE IV

TUBE ROLL GAP AND PROOF PRESSURE

Size	Flattening Gap-max		Rounding Gap-min		Proof Pressure	
	inches	mm	inches	mm	psi	KPa
-4	.218	5.54	.250	6.35	380	2 620
-6	.281	7.14	.328	8.33	280	1 931
-8	.328	8.33	.469	11.91	220	1 517
-10	.328	8.33	.578	14.68	170	1 172
-12	.328	8.33	.688	17.48	130	896
-16	.328	8.33	.828	21.03	95	655

4.6.2.2 Tensile Strength

ø Size -10 tube, and under, shall be subjected to tensile strength tests in accordance with ASTM D412, except that the separation speed shall be 2 inches (51 mm) per minute. Tubes larger than -10 shall be tested in accordance with ASTM D1457. The longitudinal tensile strength for all sizes shall be a minimum of 2,200 psi (15 168 KPa) at 77°F ±2°F (25°C ±1°C). The transverse tensile strength shall be 1,800 psi (12 411 KPa) at the same temperature. In sizes under -10, the transverse tensile strength need not be tested.

4.6.2.3 Elongation

ø The tube shall be subjected to the elongation in accordance with the ASTM methods specified in 4.6.2.2. Elongation at a temperature of 77°F ±2°F (25°C ±1°C) shall be a minimum of 200 percent.

4.6.2.4 Specific Gravity of the Tube

4.6.2.4.1 Apparent Specific Gravity

ø Apparent specific gravity shall be determined in accordance with ASTM D792, method A, and shall not exceed 2.155 at 77°F ±2°F (25°C ±1°C). Two (2) drops of wetting agent shall be added to the water.

4.6.2.4.2 Relative Specific Gravity

Relative specific gravity shall be determined in accordance with the ARP 1153 method and shall not exceed a value of 2.210 for all sizes and types of tubes.

4.6.3 Proof Pressure Test

All hose assemblies shall be pressure tested to the values specified in Table I for not less than 30 seconds and not more than five (5) minutes. The test fluid may be either water or hydraulic oil conforming to MIL-H-5606 for tests conducted at room temperature. All assemblies used for the tests described in this specification shall have this proof pressure test applied to them. Any evidence of leakage from hose or fittings, or any other evidence of malfunction shall constitute failure. Proof pressure test of hose assemblies having firesleeves shall use water as the test medium. Proof pressure shall be held for a minimum of two (2) minutes, during which time the firesleeves shall be pulled back from the end fittings.

4.6.4 Elongation and Contraction Test

ø Two (2) hose assemblies of each size shall be subjected to the elongation and contraction test. The hose shall not change in length by more than ±0.20 inch (5.1 mm) in 10 inches (254 mm) of length when subjected to the operating pressure shown in Table I for not less than five (5) minutes. With the hose held in a straight position, unpressurized, a 10-inch (254 mm) gage length shall be marked off on the hose and the hose then pressurized. After five (5) minutes, while still pressurized, the gage length shall be measured and the change in length calculated.

4.6.5 Volumetric Expansion Test

Two (2) assemblies of each size shall be tested in accordance with ASTM D571. The volumetric expansion of the test assemblies shall be in accordance with the values shown in Table I. This test shall be performed at operating pressure.

4.6.6 Leakage Test

ø Two (2) assemblies of each size shall be pressurized to 70 percent of the minimum room temperature burst pressure shown in Table I and held for five (5) minutes minimum. The pressure shall then be reduced to zero (0) psi, after which it shall again be raised to 70 percent of the minimum room temperature burst pressure for a final five (5) minute check. Any evidence of leakage from hose or fitting, hose burst, fitting blow-off or any other evidence of malfunction shall constitute failure.

4.6.7 Room Temperature Burst Pressure Test

Ø Two (2) hose assemblies of each size shall be subjected to a pressure sufficient to burst the assemblies with a rate of pressure rise equal to 20,000 psi ±5,000 psi (137 895 KPa ±34 474 KPa) per minute. The assemblies shall be observed throughout the test and the type of failure and the pressure where failure occurred shall be recorded. The assemblies shall not leak or show any evidence of malfunction at any pressure below the specified pressure listed in Table I.

4.6.8 Thermal Shock Test

The thermal shock test shall be as follows:

a. Two (2) hose assemblies of each size shall be subjected to this test. One (1) assembly shall be air aged and one (1) assembly shall be unaged. The assemblies shall be subjected to the proof pressure specified in Table I for a minimum of five (5) minutes.

b. The test assemblies shall then be mounted, empty, in a high temperature test fixture (typical setup shown in Figure 1), and the ambient temperature reduced to -65°F ±2°F (-54°C ±1°C) for a minimum of two (2) hours. At the end of this period, while still at this temperature, high temperature test fluid at a temperature of 400°F (204°C) shall be suddenly introduced at a minimum pressure of 50 psi (345 KPa). Immediately after the hot oil has filled the assembly, the pressure shall be raised to the proof pressure specified in Table I for a minimum of five (5) minutes. Not more than 15 seconds shall elapse between the introduction of the high temperature oil at 50 psi (345 KPa) and the raising of the pressure to proof pressure.

Ø c. The test assemblies shall then be filled with one of the high temperature test fluids at a pressure of 75 psi ±25 psi (517 ±172 KPa) and soaked with ambient, and fluid temperature maintained at 400°F (204°C) for one (1) hour. At the end of this period, the assemblies shall be pressurized to the proof pressure specified in Table I for a minimum of five (5) minutes. The pressure shall then be released; and while still maintaining the 400°F (204°C), the pressure shall then be increased at the same rate of rise as specified in 4.6.7 until failure is obtained. The hose assemblies shall be under continuous observation during the preceding test, and the pressure where the failure occurred and the type of failure shall be recorded.

d. During part b. and the proof portion of part c. of the test, any evidence of leakage from the hose or fittings, hose burst, fitting blow-off or any other evidence of malfunction, shall constitute failure. During the burst portion of part c., any of the above occurring below the minimum high-temperature burst pressure shown in Table I shall constitute failure.

4.6.9 Impulse Test

Impulse testing shall be performed as follows on six (6) straight-to-90° elbow hose assemblies of each size. The impulse test equipment shall conform to ARP 603 and AIR 1228.

a. Two (2) assemblies shall be oil aged, two (2) shall be air aged and two (2) shall be unaged. The assemblies shall then be subjected at room temperature to the proof pressure specified in Table I for a minimum of five (5) minutes.

b. The hose assemblies shall then be pressurized to 3000 psi (20 684 KPa), while maintaining this pressure at room temperature, the hose assemblies shall be immersed in a 3.5% NaCl solution for 8 to 10 minutes, then allowed to air dry for the remainder of one (1) hour. This subsequent immersion and air drying process shall be repeated no less than fifty (50) times.

Ø c. The test assemblies shall be connected to rigid supports and bent in a U-shape with a bend radius at the apex of the bend as specified in Table I.

d. The impulse pattern shall be as specified in ARP603, with peak pressures of 150 percent measured at the inlet manifold. Impulsing shall occur at a rate of 70 ±10 cycles per minute. The test fluid shall be one of the high-temperature test fluids. Fluid temperature shall be maintained at 400°F (204°C) and measured at the test manifold. Ambient temperature shall be 400°F (204°C), measured at a point within six (6) inches from the hose assemblies.

e. Impulse testing shall be run in such a manner that the assemblies are temperature-cycled from room temperature to specified fluid and ambient air temperatures a minimum of two (2) times, with a minimum of eighty percent (80%) of the impulse cycles at 400°F (204°C). Any evidence of leakage from the hose or fittings prior to the completion of 250,000 impulse cycles shall constitute failure.

NOTE: It is preferred that testing be continuous with a minimum number of shutdowns to accommodate shift schedules and maintenance.

4.6.10 Assembly Flex Test

Two (2) hose assemblies of each size shall be mounted in the assembly flex test setup as illustrated on Figure 2 and subjected to the following test sequence. The assemblies shall be filled with oil as specified in 4.5.3. Temperature indicated is both fluid and ambient. Flexing shall occur at a rate of 70 ±10 cpm during portions c., d., and e.

a. The test assemblies shall be soaked with no pressure or flexing at a temperature of -67°F ±2°F (-55°C ±1°C) for a minimum of one (1) hour.

b. With no flexing, the test assemblies shall be pressurized to the proof pressure as specified in Table I with the temperature still at -67°F (-55°C) for a minimum of five (5) minutes (first cycle only).

c. Flexing shall begin while the test assemblies are pressurized to the operating pressure as specified in Table I with the temperature still at -67°F (-55°C) for a minimum of 4,000 flex cycles.

ø d. With the pressure reduced to zero (0) psi, flexing shall continue for 1,000 flex cycles at -67°F (-55°C).

e. Increase the temperature to 400°F (204°C) and flex for 1,000 cycles with pressure at zero (0) psi. The pressure shall then be increased to the operating pressure specified in Table I with the temperature held at 400°F (204°C). Flexing shall continue until an accumulated total of 80,000 cycles is reached.

f. Steps a., c., d., and e. shall be repeated for a total of five (5) test sequences (i.e., 400,000 flexing cycles).

g. After completion of step f., and with no flexing, the test assemblies shall be pressurized to the proof pressure specified in Table I with the temperature still at 400°F (204°C) for a minimum of five (5) minutes (last cycle only).

Any leakage from the hose or fittings, hose burst, fitting blow-off, or any other evidence of malfunction during the test, shall constitute failure.

4.6.11 Stress Degradation Test

Two (2) hose assemblies of each size shall be subjected to the following test sequence:

a. The hose assemblies shall be filled with a high-temperature test fluid and placed in an oven which shall be maintained at a temperature of 400°F (204°C). Precautions shall be taken to assure that the hose assemblies do not come in contact with part of the oven that are at higher temperatures. A pressure equal to the operating pressure specified in Table I shall be applied to the hose assemblies.

b. After a minimum of 20 hours at 400°F (204°C), the pressure shall be gradually released and the assemblies removed from the oven, drained, and cooled to room temperature.

c. The hose assemblies shall then be filled with fluid conforming to MIL-H-5606. A pressure equal to the operating pressure specified in Table I shall be applied and held for a minimum of two (2) hours at room temperature.

d. The procedure specified in steps a., b., and c. shall be repeated a total of three (3) times.

ø e. After the final two (2) hour pressurization period, the hose assemblies shall be drained and flushed with trichloroethylene, conforming to MIL-T-27602, and placed in an oven for one (1) hour. The temperature of the oven shall be maintained at 160°F ±10°F (71°C ±5°C).

f. The hose assemblies shall be removed from the oven, cooled to room temperature, and then subjected to an air under water test. To conduct this test, the hose assemblies shall be installed in an apparatus constructed similar to that shown in Figure 3.

g. The apparatus with the hose assembly installed, shall be immersed in water containing no wetting agent. A pressure equivalent to the operating pressure specified in Table I shall be applied for 15 minutes to allow any entrapped air in the hose to escape.

h. The pressure shall be held an additional five (5) minute period, during which time the effused gas shall be collected from the test sample, including the juncture of the hose and the fitting, but not including the "B" nut. After the five (5) minute period of pressurization, the average rate of effusion through the hose and two (2) fittings shall be computed into cc/in./min. (cc/cm/min.). If the average rate of effusion exceeds 2.0 cc/in./min. (0.78 cc/cm/min.) for any size, it shall be cause for rejection and considered failure to qualify.

4.6.12 Pneumatic Surge Test

Two (2) hose assemblies that were subjected to the stress degradation (4.6.11) shall be used for this test. The hose assemblies shall be installed in the test apparatus in accordance with Figure 4. The assemblies shall be tested using compressed gas to the rated operating pressure specified in Table I, for 25 minutes at room temperature. After this ø period of pressurization, the exhaust valve shall be opened within 50 milliseconds to permit rapid discharge of the compressed gas. After five (5) minutes, the valve shall be closed and the pressure recycled. This sequence of 25 minutes at operating pressure and 5 minutes at zero (0) psi shall be repeated a total of 16 times. At the end of this period, the hose shall be sectioned and examined for evidence of tube collapse, sponging of the inner tube, etc., and the filter downstream of the hose examined for evidence of inner tube degradation. Any evidence of degradation shall constitute failure.

4.6.13 Pneumatic Effusion Test

Two (2) hose assemblies of each size shall be used for this test. The assemblies shall be subjected to the operating pressure specified in Table I for one (1) hour at room ø temperature. Air effusion shall be collected, using the water displacement method and an air collecting device similar to that depicted in Figure 3. The total amount of effusion through the hose and the two (2) fittings shall be collected over the last 1/2 hour of testing. Total effusion shall not exceed 8.0 cc/ft. (26 cc/m) of hose assembly for any size hose.

4.6.14 Overtightening Torque Test

Test procedure and recommended torque values shall be in accordance with ARP 908.

4.6.15 Conductivity Test

The conductivity test shall be conducted as follows:

a. The test specimen shall be a length of hose (with braid and one end fitting) as shown in Figure 5. The inner surface of the tube shall be washed first with solvent conforming to P-D-680, and then with isopropyl alcohol conforming to TT-I-735, to remove surface contamination, and thoroughly dried at room temperature. The wire braid shall flare out as shown in Figure 5 to prevent contact with the end of the tetrafluoroethylene tube. One MS21900 steel adapter of appropriate size shall be assembled to the hose end fitting as shown on ø Figure 5.

b. The test specimen shall then be arranged vertically as shown on Figure 5. The relative humidity shall be kept below 70 percent and room temperature between 60°F (16°C) and 90°F (32°C). One thousand (1000) volts dc shall be applied between the upper mercury electrode and the lower (MS21900 adapter) electrode.

c. The current shall be measured with an instrument with a sensitivity of at least one (1) microampere (1×10^{-6} ampere). The current measured shall be equal to or greater than, six (6) microamperes for sizes -4 through -8 and equal to or greater than, twelve (12) microamperes for sizes -10 through -16.

5. PREPARATION FOR DELIVERY

5.1 PRESERVATION AND PACKAGING

Preservation and packaging shall be level A or C, as specified (see 6.2).

5.1.1 Level A

Hose assemblies shall be preserved in accordance with method III of MIL-P-116. All ø openings shall be sealed with caps or plugs conforming to MIL-C-5501. Hose assemblies shall be unit packaged in containers conforming to PPP-B-566, PPP-B-636, PPP-B-665, or PPP-B-676. The gross weight of the boxes shall not exceed the weight limitations of the applicable container specification.

5.1.2 Level C

Hose assemblies shall be preserved and packaged in accordance with the manufacturer's commercial practice.

5.2 PACKING

Packing shall be level A, B or C, as specified (see 6.2).

5.2.1 Level A

Hose assemblies preserved and packaged to meet 5.1.1 shall be packed in exterior type ø shipping containers conforming to PPP-B-585, PPP-B-591, PPP-B-601, PPP-B-636 or PPP-B-576. Insofar as practical, exterior containers shall be of uniform shape and size, of minimum cube and tare consistent with the protection required, and shall contain identical

quantities. The gross weight of each pack shall be limited to approximately 200 pounds (90 kg.). Containers shall be closed and strapped in accordance with the applicable specification or appendix thereto. Containers shall be provided with a case liner conforming to MIL-L-10547 and shall be sealed in accordance with the appendix thereto. The case liner will not be required when the unit, intermediate, or exterior container conforms to PPP-B-636 and is sealed at all joints and seams, including manufacturer's joint, with tape conforming to PPP-T-60.

5.2.2 Level B

Hose assemblies preserved and packaged to 5.1.1 shall be packed in domestic-type exterior containers conforming to PPP-B-585, PPP-B-591, PPP-B-601, PPP-B-636 or PPP-B-576. Exterior containers shall be of minimum cube and tare consistent with the protection required.

ø Insofar as practicable, exterior containers shall be of uniform size and shape, and shall contain identical quantities. The gross weight of each pack shall be limited to approximately 200 pounds (90 kg.). Containers shall be closed and strapped in accordance with the applicable container specification or appendix thereto. When fiberboard containers are used, the fiberboard shall conform to the special requirements table of PPP-B-636.

5.2.3 Level C

Packages which require over-packing for acceptance by the carrier, shall be packed in exterior-type shipping containers in a manner that will ensure safe transportation at the lowest rate to the point of delivery. Containers shall meet Uniform Freight Classification Rules or regulations of other common carriers, as applicable to the mode of transportation.

5.3 MARKING

Interior and exterior containers shall be marked in accordance with MIL-STD-129.

5.3.1 Packing Date

The date of packing shall be marked on all interior and exterior containers.

6. NOTES

6.1 INTENDED USE

The hose assemblies are intended for use in aircraft and missile high-pressure 3,000-psi (20 684 KPa) hydraulic and pneumatic systems operating in a temperature range of -65°F to 400°F (-54°C to 204°C). High-pressure pneumatic storage system applications are not

ø recommended. Installations in which the limits specified herein are exceeded, or in which the application is not covered specifically by this specification will be subject to the approval of the procuring activity. The end fittings of these hose assemblies are not intended for reuse.

6.1.1 Fire Resistance

ø When fire proofing or fire resistance is a requirement, the test shall be conducted to the procedures and requirements specified in AS1055.

6.2 ORDERING DATA

Procurement documents should specify:

a. Title, number and date of this specification.

b. The applicable "AS" part number required.

c. Type, size or special features of end fittings desired (see 3.3.4).

d. Data requirements (see 4.3.2).

e. Applicable levels of preservation, packaging and packing (see 5.1, 5.2).

f. Samples subject to destructive testing are not to be considered or shipped as part of the contract or order.

g. When fire resistance or fire proofing is required.

6.3 MARGINAL INDICIA

The phi (Ø) symbol is used to indicate technical changes from the previous issue of this standard.

PREPARED BY SAE COMMITTEE G-3, AEROSPACE FITTINGS, HOSE AND TUBING ASSEMBLIES