SAE The Engineering Resource For Advancing Mobility

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE STANDARD

AS 1339

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Rev. B

HOSE ASSEMBLY, TETRAFLUOROETHYLENE, 400°F, 3000 PSI HYDRAULIC, LIGHTWEIGHT

1. SCOPE

This specification covers lightweight hose assemblies intended for use in high-temperature, 400°F (204°C), high-pressure, 3000 psi (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-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-H-8446	Hydraulic Fluid, Nonpetroleum Base, Aircraft
MIL-T-8504	Steel, Corrosion-Resisting (304) Aerospace Vehicle Hydraulic Systems, Annealed, Seamless and Welded

MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
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-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification of
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

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
MS19059	Balls, Bearing, Ferrous, Chrome Alloy Steel
MS21900	Adaptor, 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 may be obtained from the procuring activity or as directed by the contracting officer.

2.3 INDUSTRY PUBLICATIONS

American Society for Testing and Materials

ASTM A262	Detecting Susceptibility to Intergranular Corrosion on Stainless Steel
ASTM D412	Rubber, Determination of Tension Characteristics
ASTM D571	Rubber Hose for Automotive Hydraulic Brake Systems
ASTM D792	Specific Gravity and Density of Plastics by Displacement
ASTM D1457	TFE - Fluorocarbon Resin Molding and Extrusion Materials

Copies may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

Society of Automotive Engineers

Material Specifications:

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 18.5 Cr - 10.5 Ni - 0.40 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 - 11 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)
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 - 1Al
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

Aerospace Recommended Practices:

ARP 603	Impulse Testing of Hydraulic Hose, Tubing and Fitting Assemblies
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, PTFE Tubing

ARP 1835 Preparation for Delivery, General Requirements for Hose Assemblies

Aerospace Standards:

AS115	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flareless, Straight to Straight, Lightweight
AS116	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flareless, Straight to 45°, Lightweight
AS117	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flareless, Straight to 90°, Lightweight
AS118	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flareless, 45° to 45°, Lightweight
AS119	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flareless, 45° to 90°, Lightweight
AS120	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flareless, 90° to 90°, Lightweight
AS153	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flared, Straight to Straight, Lightweight
AS154	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flared, Straight to 45°, Lightweight
AS155	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flared, Straight to 90°, Lightweight
AS156	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flared, 45° to 45°, Lightweight
AS157	Hose Assembly, Nonmetallic - 3,000 psi, TFE, Flared, 45° to 90°, Lightweight
AS158	Hose Assembly, Nonmetallic - 3,000 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
AS1624	Polytetrafluoroethylene (PTFE), Lightweight, 3000 psi, High Temperature, Hydraulic and Pneumatic

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

National Aerospace Standards:

NAS1760	Fitting End, Flareless Acorn, Standard Dimensions for

Copies may be obtained from the National Standards Association, Inc., 5161 River Road, Washington, DC 20016.

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, such as:

AS115	AS153
AS116	AS154
AS117	AS155
AS118	AS156
AS119	AS157
AS120	AS158

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 as 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.

3.3.3 Fittings

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 NAS1760 to mate with MS33514. Fitting hexagonal 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.

3.3.4.3 Sockets

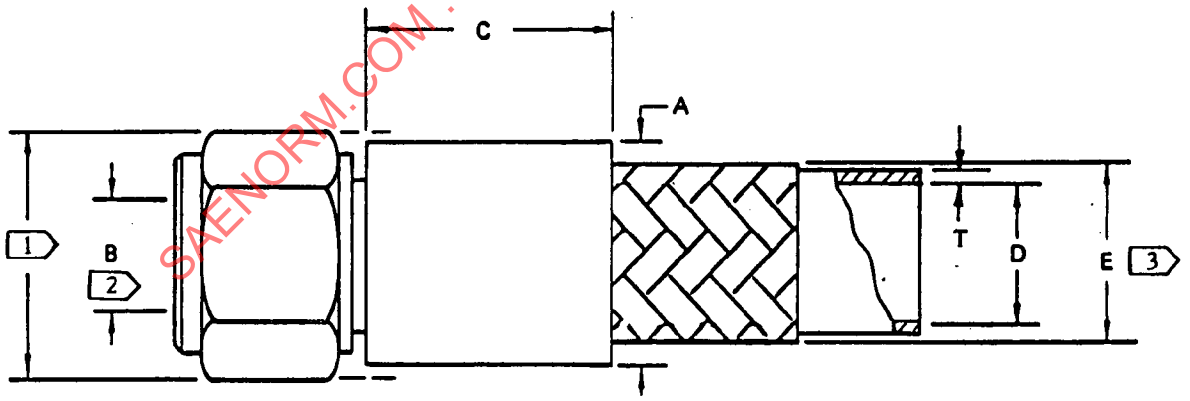
Crimped or swaged sockets of 304 steel shall pass testing per ASTM A262 practice E prior to crimping or swaging. Note: This requirement does not apply to sockets of 321, 347 or 304L corrosion resistant steel.

3.4 ASSEMBLY DIMENSIONS

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

3.4.1 Hose Weight

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



HOSE AND FITTING DIMENSIONS

Figure 1

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

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

3 Hose outside diameters are in accordance with AS1624.

TABLE I. HOSE AND FITTING DIMENSIONS

Hose Size	Rigid Tube O.D. (Ref) inch	Fitting O.D. A Max inch	Fitting I.D. B Min inch	Socket Length C Max inch	Hose I.D. D [1] Min inch	Hose O.D. E [1]		Unbraided PTFE Wall Thickness T [1]	
						Min inch	Max inch	Min inch	Max inch
04	.250	.690	.135	.98	.212	.360	.390	.035	.046
06	.375	.800	.240	1.09	.298	.455	.490	.035	.046
08	.500	.970	.340	1.33	.391	.585	.615	.040	.051
10	.625	1.100	.410	1.36	.485	.690	.730	.045	.056
12	.750	1.380	.510	1.40	.602	.950	.990	.045	.056
16	1.000	1.660	.760	1.60	.852	1.230	1.270	.045	.056

[1] Listed for reference, dimensions specified in AS 1624.

TABLE II. PHYSICAL REQUIREMENTS OF HOSE ASSEMBLIES AND WEIGHT OF HOSE

Hose Size	Hose Weight Maximum [1] lbs/inch	Operating Pressure psi	Proof Pressure psi	Burst Pressure		Bend Radius at Inside of Bend Minimum inch	Volumetric Expansion Maximum cm^3/inch
				Room Temperature Minimum psi	High Temperature Minimum psi		
-04	.009	3 000	6 000	16 000	12,000	1.50	.065
-06	.015	3 000	6 000	14 000	10 500	2.50	.085
-08	.020	3 000	6 000	14 000	10 500	2.88	.135
-10	.027	3 000	6 000	12 000	9 000	3.25	.220
-12	.055	3 000	6 000	12 000	9 000	4.00	.300
-16	.085	3 000	6 000	12 000	9 000	5.00	.750

[1] Hose weight shall be determined on a minimum length of 12 inches.

3.5 PERFORMANCE

The inner tube and 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.

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 III and under 4.6.2.1.

TABLE III. TUBE ROLL GAP AND PROOF PRESSURE

Size	Flattening Gap Maximum Inch	Rounding Gap Minimum Inch	Proof Pressure PSI
-04	.281	.250	380
-06	.281	.328	280
-08	.328	.469	220
-10	.328	.578	170
-12	.328	.688	130
-16	.328	.828	95

3.5.1.3 Tensile Strength

The longitudinal tensile strength for all sizes of tubes shall be 2 200 psi minimum at 77 ± 2°F when tested in accordance with 4.6.2.2. The transverse tensile strength for sizes -10 and larger shall be 1 800 psi minimum at the same temperature. For sizes under -10 the transverse strength need not be tested.

3.5.1.4 Elongation

Elongation at 77 ± 2°F 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 II 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 II 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 II.

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 II, 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 -65 to 400°F 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 as specified in 4.6.10 from -65 to 400°F.

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 2.0 cm^3/inch/minute for any size.

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 8.0 cm^3/ft.

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 -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, direct current.

3.6 SCREW THREADS

Fitting threads shall be in accordance with MIL-S-8879. 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 18 inches, not less than 1/8 inch
18-36 inches, not less than 1/4 inch
36-50 inches, not less than 1/2 inch
Over 50 inches, not less than 1 inch

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

Tolerances on hose assembly lengths shall be as follows:

±1/8 inch for lengths under 18 inches
±1/4 inch for lengths from 18-36 inches
±1/2 inch for lengths from 36-50 inches
±1% for lengths over 50 inches

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.

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 and shall not impair the flexibility or the performance of the hose. The marking on the fitting or band shall include the following information:

a. Assembly manufacturer's name or trademark, and specification number (AS 1339)
b. Complete hose assembly part number
c. Operating pressure "3000 psi" as applicable
d. Operating temperature "400°F 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

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 will be acceptable.

3.10.1 Dimensions and Tolerance

All pertinent dimensions and tolerances, where interchangeability, operation, or performance of the hose assembly may be affected, shall be specified on all drawings. Internal passages of hose assemblies and elbow fittings shall be dimensioned to allow spherical balls per MS19059 per Table IV to roll through.

TABLE IV

SPHERICAL BALL SIZE FOR VERIFYING

MINIMUM HOSE ASSEMBLY AND FITTING I.D.

Hose Size	MS19059 Dash No.	Diameter Inch
04	4807	.109
06	4812	.188
08	4816	.313
10	4818	.375
12	4821	.469
16	4829	.719

3.10.2 Cleaning

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

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 purchaser 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)

4.3 QUALIFICATION INSPECTIONS

4.3.1 Qualification Test Samples

Test samples shall consist of the number of samples and lengths specified in Table V for each method of fitting attachment, permanent and reusable. The end fitting outlet design for the samples shall have flared fittings to mate with MS33656 or flareless fittings according to NAS1760 to mate with MS33514.

TABLE V. LENGTH OF HOSE ASSEMBLIES FOR TEST

Hose Assembly Size	Six Assemblies for Impulse Test (4.6.9) Inch	Two Assemblies for Flex Test (4.6.10) Inch	Six Assemblies for Other Tests [2] Inch
-04	12	16	18
-06	15	19	18
-08	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 6 shall be used for examination and conductivity tests (sample No. 16 of Table VI).

4.3.2 Qualification Test Sequence

The tests shall be conducted in the sequence shown in Table VI.

TABLE VI. QUALIFICATION TEST SCHEDULE

Sample No.	PTFE Tube	Hose Assemblies									
	1 [3]	2	3	4	5	6	7	8	9	10 through 15 [4]	16
Paragraph 4.6.: -	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
	.2	.3	.3	.3	.3	.3	.3	.3	.3	.3	.15
		.4	.4	.5	.5	.6	.6	.11	.11	.9	
		.10	.10	.13	.13	.8	.8	.12	.12		
		.14	.14	.7	.7						

NOTE: All assemblies to have a flared fitting on one end and a flareless fitting on the other, except [4].

[3] 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] 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.

4.3.3 Test Report, Test Samples, and Data for the Purchaser

When the tests are conducted at a location other than the laboratory of the purchaser, 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. The samples which were tested, only when especially requested by the purchaser.

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, and recorded test data, shall remain on file at the source test facility and are not to be sent to the qualifying activity unless specifically requested.

4.3.4 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% 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
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

The following inspections or tests shall be performed in the order indicated on eight (8) hose assemblies, selected at random from each inspection lot. The inspection lot shall consist of no more than 3 000 hose assembies, all of one dash number size, manufactured under essentially the same conditions. One (1) hose assembly tested from each lot of 375 hose assemblies is also permitted.

a. Internal cleanliness (ARP 611, Class 0)
b. Leakage tests - 4.6.6
c. Room - temperature burst pressure test - 4.6.7
d. Specific gravity tests (apparent and relative) - 4.6.2.4

4.4.3 Periodic Control Tests

The following inspections and tests shall be performed as indicated on eight (8) hose assemblies manufactured from bulk hose lengths selected at random from each inspection lot. The inspection lot shall consist of not more than 20 000 feet of hose, all of one dash number size, manufactured under essentially the same conditions. Two (2) hose assemblies manufactured and tested from each lot of 5 000 feet of hose is also permitted.

4.4.3.1 Pressure Tests

Four (4) hose assemblies (or one (1) hose assembly from a lot of 5 000 feet) in accordance with Table II shall be subjected to the following tests in the order indicated:

a. Elongation and contraction - 4.6.4
b. Impulse test - 4.6.9

4.4.3.2 Material Tests, Inner Tube

Four (4) hose assemblies (or one (1) hose assembly from a lot of 5 000 feet) in accordance with Table II shall be subjected to the following tests in the order indicated:

a. Stress degedration test - 4.6.11
b. Conductivity test - 4.6.15

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

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 Changing Inspection Procedures

Changing 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

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.

4.5.2 Preparation of Sample

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

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 NAS1760 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, in the sequence indicated:

a. Examination of product - 4.6.1
b. Proof pressure test - 4.6.3
c. Leakage test - 4.6.6
d. Repeated assembly test - 4.6.14
e. Room temperature burst pressure test - 4.6.7

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 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 for seven days.

4.5.2.5 Unaged Samples

Unaged assemblies shall be as manufactured.

4.5.3 Test Fluids

Unless otherwise specified, the pressure test fluid shall be hydraulic oil conforming to MIL-H-5606, or water. For 400°F testing, the test fluid shall be MIL-H-8446 or MIL-H-83282 hydraulic fluid, or equivalent, unless otherwise specified by the user.

4.5.4 Temperature Measurements

Unless otherwise specified, temperature measurements shall be taken within six inches of the hose assemblies under test. Unless otherwise specified, all temperatures shall have a tolerance of +15°F, -5°F.

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.

4.5.6 Pressure Measurements

Unless otherwise specified, all pressures shall have a tolerance of ±100 psi.

4.6 INSPECTION METHODS

4.6.1 Examination of Product

4.6.1.1 Inner Tube

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

4.6.1.2 Hose Assembly

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. Minimum inside diameters of end fittings shall be verified by passing a MS 19059 ball per Table IV through the assembly.

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 III. The test fluid shall be air or water. See 3.5.1.1 and 3.5.1.2.

4.6.2.2 Tensile Strength

Size -10 tube, and under, shall be subjected to tensile strength tests in accordance with ASTM D412, except that the separation speed shall be two inches per minute. Tubes larger than -10 shall be tested in accordance with ASTM D1457. See 3.5.1.3.

4.6.2.3 Elongation

The tube shall be subjected to the elongation in accordance with the ASTM methods specified in 4.6.2.2. See 3.5.1.4.

4.6.2.4 Specific Gravity of the Tube

4.6.2.4.1 Apparent Specific Gravity

Apparent specific gravity shall be determined in accordance with the ARP 1153 or ASTM D792, method A, at 77 $\pm$ 2°F. Two (2) drops of wetting agent shall be added to the water. When test samples are prepared from braided hose, the braid impressions must be removed prior to testing. See 3.5.1.5.

4.6.2.4.2 Relative Specific Gravity

Relative specific gravity shall be determined in accordance with the ARP 1153 method for all sizes and types of tubes. See 3.5.1.5.

4.6.3 Proof Pressure Test

All hose assemblies shall be pressure tested to the values specified in Table II 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. See 3.5.2.1.

4.6.4 Elongation and Contraction Test

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 2% for ten inches of length when subjected to the operating pressure shown in Table II for not less than five (5) minutes. With the hose held in a straight position, unpressurized, a minimum gage length of 10 inches 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 in % of the initial gage length. See 3.5.2.2.

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 II. This test shall be performed at operating pressure. See 3.5.2.3.

4.6.6 Leakage Test

Two (2) assemblies of each size shall be pressurized to 70 percent of the minimum room temperature burst pressure shown in Table II and held for five (5) minutes minimum. The pressure shall then be reduced to zero (0), 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 the hose or fitting, hose burst, fitting blow-off, or any other evidence of malfunction shall constitute failure. See 3.5.2.4.

4.6.7 Room Temperature Burst Pressure Test

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 per minute. The assemblies shall be observed throughout the test. The type of failure and the pressure where failure occurred shall be recorded. The assemblies shall not leak or show other evidence of malfunction at any pressure below the specified pressure listed in Table II. See 3.5.2.5.

4.6.8 Thermal Shock Test

The thermal shock test shall be as follows (See 3.5.2.6):

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 II 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 2), and the ambient temperature reduced to -65 ± 2°F 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 shall be suddenly introduced at a minimum pressure of 50 psi. Immediately after the hot oil has filled the assembly, the pressure shall be raised to the proof pressure specified in Table II 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 and the raising of the pressure to proof pressure.

c. The test assemblies shall then be filled with one of the high temperature test fluids at a pressure of 75 ± 25 psi and soaked with ambient, and fluid temperature maintained at 400°F for one (1) hour. At the end of this period, the assemblies shall be pressurized to the proof pressure specified in Table II for a minimum of five (5) minutes. The pressure shall then be released; and while still maintaining the 400°F 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. Any evidence of leakage from the hose or fittings, fitting blow-off, or any other evidence of malfunction prior to final burst per c. above, 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. See 3.5.2.7.

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 II for a minimum of five (5) minutes.

b. The hose assemblies shall then be pressurized to 3 000 psi while maintaining this pressure at room temperature, the hose assemblies shall be immersed in a 3.5% ± 0.1% 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.

NOTE: The NaCl solution shall contain a dry basis of not more than 0.1% sodium iodine and 0.5% total impurities.

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 II.

d. The impulse pattern shall be as specified in ARP 603, 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 and measured at the test manifold. Ambient temperature shall be 400°F, 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. 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 Flexibility Test

Two (2) hose assemblies of each size shall be mounted in the assembly flex test setup as illustrated on Figure 3 and Table VII, 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 cycles per minute during portions c., d., and e. See 3.5.2.8.

Table VII

Flexure Test Dimensions

Hose Size	A (Fig. 3) Inches
-04	3.50
-06	5.62
-08	6.50
-10	7.25
-12	9.00
-16	11.12

a. The test assemblies shall be soaked with no pressure or flexing at a temperature of -65 ± 2°F 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 II with the temperature still at -65 ± 2°F 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 II with the temperature still at -65 ± 2°F for a minimum of 4 000 flex cycles.

d. With the pressure reduced to zero (0), flexing shall continue for 1,000 flex cycles at -65 ± 2°F.

e. Increase the temperature to 400°F and flex for 1,000 cycles with pressure at zero (0). The pressure shall then be increased to the operating pressure specified in Table II with the temperature held at 400°F. 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 II with the temperature still at 400°F for a minimum of five (5) minutes (last cycle only).