

Issued 1992-06  
Revised 2003-05  
Reaffirmed 2013-01Hose Assembly, 3000 psi, Polytetrafluoroethylene, Metallic  
Reinforced, 400 °F, Heavy Duty, Aircraft Hydraulic Systems**RATIONALE**

AS4604B has been reaffirmed to comply with the SAE five-year review policy.

**1. SCOPE:**

This SAE Aerospace Standard (AS) defines the requirements for heavy-duty polytetrafluoroethylene (PTFE) lined, metallic reinforced, hose assemblies suitable for use in 400 °F, 3000 psi aircraft hydraulic systems. Assemblies are suitable where rapid rate pressure pulsing and torsional/longitudinal flexing may occur, in addition to normal hydraulic system loads.

**2. APPLICABLE DOCUMENTS:**

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this specification and references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

**2.1 SAE Publications:**

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2486	Conversion Coating of Titanium Alloys, Fluoride-Phosphate Type
AMS 2488	Anodic Treatment, Titanium and Titanium Alloys
AMS 4928	Bars and Forgings - 6Al 4V, Annealed - 120,000 psi
AMS 4945	Tubing, Seamless, Hydraulic, 3Al 2.5V, Texture Controlled, 105,000 psi (724 MPa) Yield Strength
AMS 4965	Bars, Forgings and Rings - 6Al 4V, Sol. and Precip. Heat Treated
AMS 5556	Steel Tubing, Seamless or Welded, Corrosion and Heat-Resistant, 18Cr - 11Ni - (Cb+Ta) (SAE 30347) Hydraulic
AMS 5557	Steel Tubing, Seamless or Welded, Corrosion and Heat -Resistant, 18Cr - 11Ni (SAE 30321) Hydraulic

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## 2.1 (Continued):

AMS 5567	Steel Tubing, Seamless and Welded, Corrosion Resistant, 19Cr - 10Ni (SAE 30304) Hydraulic, Solution Treated
AMS 5570	Steel Tubing, Seamless, Corrosion and Heat-Resistant 18Cr - 11Ni - 0.40Ti (SAE 30321)
AMS 5571	Steel Tubing, Seamless, Corrosion and Heat-Resistant, 18Cr - Ni - 0.70(Cb+Ta) (SAE 30347)
AMS 5575	Steel Tubing, Welded, Corrosion and Heat-Resistant, 18Cr - 10.5Ni - 0.70(Cb+Ta) (SAE 30347)
AMS 5639	Steel Bars, Forgings, Tubing, and Rings, Corrosion-Resistant, 19Cr - 10Ni (SAE 30304)
AMS 5643	Steel Bars, Forgings, Tubing, and Rings, Corrosion Resistant, 16.5Cr - 4.0Ni - 4.0Cu
AMS 5644	Steel Bars and Forgings, Corrosion and Heat Resistant 17Cr - 7Ni - 1Al
AMS 5645	Steel Bars, Forgings, Tubing and Rings, Corrosion and Heat Resistant 18Cr - 10Ni - 0.40Ti (SAE 30321)
AMS 5646	Steel Bars, Forgings, Tubing and Rings, Corrosion and Heat Resistant 18Cr - 11Ni - 0.60(Cb+Ta) (SAE 30347)
AMS 5647	Steel Bars, Forgings, Tubing and Rings, 18Cr - 8Ni
AMS 5659	Steel Bars, Forgings, and Rings, Corrosion Resistant 15Cr - 4.5Ni - 0.30(Cb+Ta) - 3.5Cu Consumable Electrode Melted
AMS 5688	Steel Wire, Corrosion-Resistant, 18Cr - 9.0Ni (SAE 30302) Spring Temper
AMS 5689	Steel Wire, Corrosion and Heat-Resistant, 18Cr - 9.5Ni - Ti (SAE 30321) Solution Heat Treated
AMS 5743	Steel Bars and Forgings, Corrosion and Moderate Heat-Resistant 15.5Cr - 4.5Ni - 2.9Mo - 0.10N, Solution Heat Treated, Sub-Zero Cooled, Equalized and Over-Tempered
AMS-QQ-P-35	Passivation Treatments for Corrosion - Resistant Steel
ARP603	Impulse Testing of Hydraulic Hose Assemblies, Tubing and Fittings
AS150	Hose Assembly, Type Classification of, Basic Performance and Fire Resistance
AS611	Polytetrafluoroethylene Hose Assembly Cleaning Methods
ARP908	Torque Requirements, Installation and Qualification Test, Hose and Tube Fittings
AS1055	Fire Testing of Flexible Hose Tube Assemblies, Coils, Fittings, and Similar Systems
AS1072	Sleeve, Hose Assembly, Fire Protection
AIR1228	Standard Impulse Machine Equipment Operation
AS2078	Test Methods, Hose Assemblies, Polytetrafluoroethylene (PTFE)
ARP1835	Preparation for Delivery, General Requirements for Hose Assemblies
AS4265	Impulse Testing of Hydraulic Tubing and Fittings, S-N Curve
AIR4298	Impulse Test Machine, Sine Wave, Equipment and Operation of
AS4375	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal

## 2.1 (Continued):

AS4395	Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seal
AS4488	Tubular Assemblies, Fusion Welded, Inspection Processes and Acceptance Standards for
AS4658	Fitting End, External Thread, Short Flareless, Design Standard
AS4703	Fitting End, Acorn, Short Flareless, Design Standard
AS8879	Screw Threads, Controlled Radius Root With Increased Minor Diameter, General Specification of

## 2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

ASTM A 262	Detecting Susceptibility to Intergranular Attack on Stainless Steel
ASTM A 580	Standard Specification for Stainless and Heat Resisting Steel Wire
ASTM B 348	Specification for Titanium and Titanium Alloy Bars and Billets, Grade 2

## 2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

P-D-680	Dry Cleaning Solvent
QQ-S-763	Steel Bars, Wire Shapes, and Forgings, Corrosion-Resisting
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordinance (Inactive For New Design)
MIL-PRF-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-PRF-83282	Hydraulic Fluid, Fire-Resistant, Synthetic, Hydrocarbon Base, Aircraft
MIL-F-85421	Fittings, Tube, Fluid Systems, Separable, Beam Seal, 3000/4000 psi, General Requirements for
MIL-F-85421/1	Fitting End, Standard Dimensions for Dynamic Beam Seal, Male
MIL-STD-100	Engineering Drawing Practices for Inspection
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-831	Test Reports, Preparation of

## 2.4 National Aerospace Standards:

Available from Aerospace Industries Association, 1250 Eye Street N.W., Washington, DC 20005.

NAS1760	Fitting End, Flareless Acorn, Standard Dimensions for
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## 2.5 ASME Publications:

Available from ASME, 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900.

ASME B46.1      Surface Finish

## 3. TECHNICAL REQUIREMENTS:

### 3.1 Qualification:

The hose assemblies furnished under this document shall be products which are qualified by meeting all the requirements covered by this document, such as AS4605 through AS4622.

### 3.2 Material and Finish:

The hose assembly materials shall be uniform in quality, free from defects, consistent with good manufacturing practice, and shall conform to applicable specifications and requirements specified herein.

#### 3.2.1 Metals: Metals used in the hose and fittings shall be corrosion-resistant and shall conform to the applicable specifications as follows:

##### a. Bars and Forgings:

QQ-S-763	Class 304 - Condition A or Condition B (AMS 5639)
QQ-S-763	Class 304L - Condition A (AMS 5647)
QQ-S-763	Class 321 - Condition A (AMS 5645)
QQ-S-763	Class 347 - Condition A (AMS 5646)
AMS 4928	6Al-4V Titanium - Annealed
AMS 4965	6Al-4V Titanium - Solution Treated
AMS 5643	17-4 PH Solution Heat Treated
AMS 5644	17-7 PH Solution Heat Treated
AMS 5659	15-5 PH Solution Heat Treated
AMS 5743	AM 355 - Solution Heat Treated

##### b. Tubing:

AMS 5567	Type 1 or Type 2 Stainless Steel Tubing, 304
AMS 5557	Type 1 or Type 2 Stainless Steel Tubing, 321
AMS 5570	Seamless Stainless Steel Tubing, 321
AMS 5571	Seamless Stainless Steel Tubing, 347
AMS 5575	Welded Stainless Steel Tubing, 347
AMS 5556	Type 1 or Type 2 Stainless Steel Tubing, 347
AMS 4945	Titanium 3Al-2.5V Texture Controlled

### 3.2.1 (Continued):

#### c. Wire:

- ASTM A 580 Comp. 302 (AMS 5688)
- ASTM A 580 Comp. 304 (AMS 5639)
- ASTM A 580 Comp. 321 (AMS 5689)

### 3.3 Design and Construction:

The hose assembly shall consist of a seamless PTFE inner tube, multi-layered corrosion-resistant steel-wire reinforcement, and corrosion-resistant steel and/or titanium end fittings as required to meet the construction and performance requirements of this document and as required for its intended use.

- 3.3.1 Inner Tube: The inner tube shall be of a seamless construction of virgin PTFE 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 multiple layers 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.
- NOTE: High density (plait consist of more than 12 wires) braid construction is not permitted.
- 3.3.3 Fittings: All fittings shall be permanently attached and proven to meet the requirements herein. Standard hose assemblies shall have flared fittings to mate with AS4395, flareless fittings according to NAS1760 to mate with AS4375 or short flareless fittings according to AS4703 to mate with AS4658 or beam seal fittings to mate with male fittings per MIL-F-85421. Fitting hexagonal portions shall fit standard wrench openings.
- 3.3.3.1 Insert Fittings: Standard insert fittings shall be of one piece construction. Welded or brazed joints must not be located in the fluid path.
- 3.3.3.2 Other Fittings: Other fittings including elbow fittings shall be of one piece construction to the maximum extent possible. Those made with other than one piece construction can use welded and redrawn CRES tubing in accordance with 3.2.1 or titanium tubing per AMS 4945 and shall employ a butt-weld joint method in accordance with AS4488.
- 3.3.3.3 End Fitting Collars (Sockets): All end fitting collars (sockets) crimped or swaged, fabricated from Type 304 stainless steel are required to be capable of passing an embrittlement test as specified in ASTM A 262 Practice E, prior to assembly to the nipple or swaging operation. Sockets fabricated from stabilized austenitic steel (304L, 321, or 347) or titanium are acceptable without being subjected to the embrittlement test. Titanium sockets are per ASTM B 348 - Grade 2.

### 3.3.3.4 Finish:

3.3.3.4.1 Corrosion Resistant Steel Parts: Unless otherwise specified, corrosion resistant steel parts shall be passivated in accordance with AMS-QQ-P-35.

3.3.3.4.2 Titanium Alloy Parts: Titanium alloy parts shall be fluoride phosphate coated per AMS 2486 or anodized per AMS 2488 Type 2, unless otherwise specified.

### 3.4 Assembly Dimensions:

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

3.4.1 Hose Weight: Hose consisting of inner tube and reinforcement as outlined in 3.3.1 through 3.3.2 shall not exceed the maximum hose weights specified in Table 2.

### 3.5 Performance:

The inner tube and hose assembly shall meet the following performance requirements:

#### 3.5.1 Inner 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 tested to the AS2078 (3000 psi and higher) proof pressure values for 1 min. The test method is specified in 4.6.2.1.

3.5.1.3 Tensile Strength: The longitudinal tensile strength for all sizes of tubes shall be 2200 psi minimum when tested in accordance with 4.6.2.2. The transverse tensile strength for sizes -10 and larger shall be 1800 psi minimum. For sizes under -10 the transverse strength need not be tested.

3.5.1.4 Elongation: Elongation shall be a minimum of 200% 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 2.190 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 requirements:

3.5.2.1 Proof Pressure: The hose assembly shall withstand the proof pressure listed in Table 2 without malfunction or leakage, when tested as specified in 4.6.3.

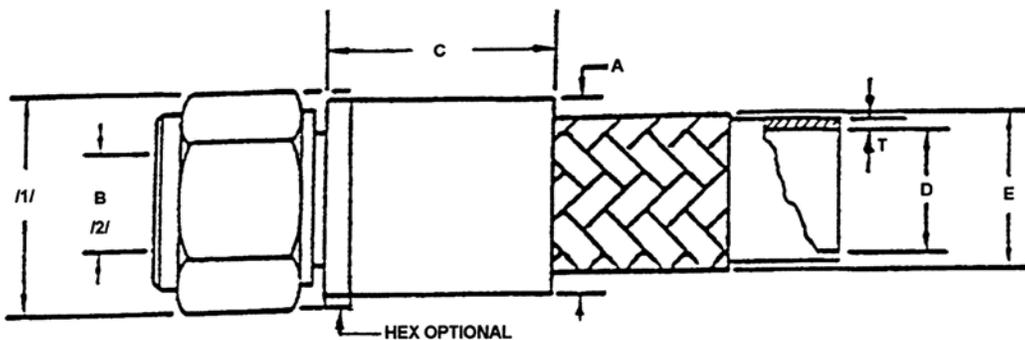


FIGURE 1 - Hose and Fitting Dimensions

TABLE 1 - Hose and Fitting Dimensions as Shown in Figure 1 (in)

Hose Size	Rigid Tube OD (ref)	Fitting OD A Max	Fitting ID B Min	Socket Length C Max	Hose ID D Min	Hose OD E Min	Hose OD E Max	Unbraided PTFE Wall Thickness T Min
	04	.250	.875	.135	2.25	.212	.425	.495
06	.375	1.000	.240	2.50	.298	.530	.600	.035
08	.500	1.200	.340	2.75	.391	.660	.730	.040
10	.625	1.406	.410	3.00	.485	.835	.905	.045
12	.750	1.687	.510	3.25	.602	1.015	1.085	.045
16	1.000	2.000	.760	3.75	.852	1.210	1.340	.050
20	1.250	2.100	.925	3.88	1.101	1.560	1.630	.050

/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. The ball diameter shall be not less than 90% of the value(s) shown for a straight fitting nor less than 85% of the value(s) shown for an elbow fitting.

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

Hose Size	Hose Weight Max /1/ lb/in	Operating Pressure psi	Proof Pressure psi	Burst Pressure Room Temperature Min psi	Burst Pressure High Temperature Min psi	Bend Radius at inside of Bend Min in	Volumetric Expansion Max cm <sup>3</sup> /in
04	.022	3000	6000	16 000	12 000	3.00	.065
06	.037	3000	6000	14 000	10 500	5.00	.085
08	.045	3000	6000	14 000	10 500	5.75	.135
10	.070	3000	6000	12 000	9 000	6.50	.220
12	.095	3000	6000	12 000	9 000	7.75	.300
16	.160	3000	6000	12 000	9 000	9.63	.750
20	.210	3000	6000	12 000	9 000	12.00	1.000

/1/ Hose weight shall be determined on a minimum length of 12 in

- 3.5.2.2 Elongation and Contraction: The hose assembly shall not change in length by more than  $\pm 2\%$  in 10 inches of hose length when subjected to the operating pressure in Table 2 for a minimum of 5 min. 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 2.
- 3.5.2.4 Leakage: The hose assembly shall not leak (no external wetting) when subjected to two pressure cycles of 70% 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 2, 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 as specified in 4.6.8 after being thermally shocked by rapidly increasing temperature from -65 to 400 °F.
- 3.5.2.7 Torsion - Impulse: The hose assemblies shall be capable of withstanding 250,000 (ARP603) impulse cycles including torsion for the last 50,000 cycles and one million rapid rate impulse cycles when tested in accordance with 4.6.9. Any hose or fitting leakage, hose burst, fitting blowout, or any other evidence of malfunction during the test shall constitute failure.
- 3.5.2.8 Assembly Flexibility: The hose assembly shall not leak when flex cycle tested from -65 to 400 °F as specified in 4.6.10. Any leakage from the hose or fittings, hose burst, fitting blowout, or any other evidence of malfunction during the test shall constitute failure.

- 3.5.2.9 Stress Degradation (Air Leakage): The air leakage rate from the hose and two end fittings (not including "B" nuts) when held at Table 2 operating pressure after completion of the stress degradation test, shall not exceed 2.0 cc/in/min when tested in accordance with 4.6.11.
- 3.5.2.10 Repeated Assembly: The fitting shall withstand, without leakage or failure, the repeated assembly test as described under 4.6.12. There shall be no leakage, galling or other malfunction in proof testing, or pneumatic testing after the last assembly cycle.
- 3.5.2.11 Electrical Conductivity: When tested as specified in 4.6.13, the hose assemblies of sizes -04 through 08 shall be capable of conducting a DC equal to or greater than 6  $\mu$ A, and sizes -10 through -20 a current equal to or greater than 12  $\mu$ A, with a test potential of 1000 V DC.

### 3.6 Screw Threads:

Coupling nut threads shall be in accordance with AS8879. Thread tolerance (increase of 10% during assembly or testing shall not be cause for rejection of the hose assembly).

### 3.7 Length:

Tolerances on hose assembly lengths shall be as follows:

- a.  $\pm 0.125$  for lengths under 18 in
- b.  $\pm 0.250$  in for lengths from 18 to 36 in exclusive
- c.  $\pm 0.500$  in for lengths from 36 to 50 in exclusive
- d.  $\pm 1\%$  for lengths of 50 in and over

### 3.8 Part Numbering and 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 1 in 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 AS4604
- b. CAGE code - 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 CAGE code number (required only when hose manufacturer is different than the hose assembly manufacturer)
- h. Fire resistance type per AS1055, type and class or AS150 and type (when applicable)

### 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  $\mu$ m Ra maximum per ASME B46.1 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.

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 AS611, using approved alkaline cleaners only. Do not use chlorinated solvents.

## 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 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 Inspection:

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 3. The end fitting outlet design for the samples shall have flared fittings to mate with AS4395 flareless fittings according to NAS1760 to mate with AS4375, short flareless fittings in accordance with AS4703 to mate with AS4658, or beam seal fittings to mate with male fitting per MIL-F-85421.

If a supplier qualifies one end fitting outlet design and at a later date desires to qualify others, two hose assemblies of each size and type to be qualified shall be subjected to the tests specified in 4.5.2.2.

TABLE 3 - Length of Hose Assemblies for Test

Hose Assembly Size	Six Assemblies for Impulse Test (4.6.9) in	Two Assemblies for Flex Test (4.6.10) in	Six Assemblies for Other Tests /1/ in
04	17.0	20	18
06	24.5	28	18
08	28.5	32	18
10	32.0	35.5	18
12	39.0	43.0	18
16	30.0 (90*)	50.0	18
20	35.0 (90*)	58.0	18

/1/ One additional sample of each size in lengths as shown in Figure 3 shall be used for examination and conductivity tests (sample No. 16 of Table 6)

4.3.2 Qualification Test Sequence: The tests shall be conducted in the sequence shown in Table 4.

TABLE 4 - Qualification Test Schedule

	PTFE Tube 1 /1/	Hose Assys 2, 3	Hose Assys 4, 5	Hose Assys 6, 7	Hose Assys 8, 9	Hose Assys 10 through 15 /2/	Hose Assy 16
4.6.1.1 Examination of Product	○						
4.6.2.1 Tube Roll	○						
4.6.2.1 Proof Pressure	○						
4.6.2.2 Tensile Strength	○						
4.6.2.3 Elongation	○						
4.6.2.4 Specific Gravity	○						
4.6.1.2 Examination of Product		○	○	○	○	○	○
4.6.3 Proof Pressure		○	○	○	○	○	○
4.6.4 Elongation and Contraction		○					
4.6.5 Volumetric Expansion			○				
4.6.6 Leakage				○			
4.6.7 Room Temperature Burst Pressure			○				
4.6.8 Thermal Shock				○			
4.6.9 Torsion-Impulse						○	
4.6.10 Assembly Flexibility		○					
4.6.11 Stress Degradation					○		
4.6.12 Repetitive Assembly Torque		○					
4.6.13 Electrical Conductivity							○

NOTE: End fitting outlet design shall have flared, flareless, or beam seal straight end fittings except /2/.

/1/ 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.

/2/ 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 (three) shall use one type of configured elbow, while the other half of the samples use the other type.

4.3.3 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: The test report shall be in accordance with MIL-STD-831, which shall include a report of all tests and outline description of the tests and conditions.
- b. Test Samples: The samples which were tested, only when especially requested by the purchaser.
- c. Drawings: Three sets of engineering data in the form of subassembly 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 subassemblies
- d. Sources: 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 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 dried prior to capping (see cleaning requirements, 3.10.2).

- 4.4.2 Sampling Tests: The following inspections and tests shall be performed in the order indicated on eight hose assemblies, selected at random from each inspection lot. The inspection lot shall consist of no more than 3000 hose assemblies, all of one dash number size, and manufactured under essentially the same conditions. One hose assembly tested from each lot of 375 hose assemblies is also permitted. The hose assemblies may have straight end fittings on both ends.
- a. Internal cleanliness (AS611, Class 0)
  - b. Leakage test - 4.6.6
  - c. Room - temperature burst pressure test - 4.6.7
- 4.4.3 Periodic Control Tests: The following inspections and tests shall be performed as indicated on eight 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 ft of hose, all of one dash number size, and manufactured under essentially the same conditions. Two hose assemblies manufactured and tested from each lot of 5000 ft of hose is also permitted. The hose assemblies may have straight end fittings on both ends.
- 4.4.3.1 Pressure Tests: Four hose assemblies (or one hose assembly from a lot of 5000 ft) in accordance with Table 3 shall be subjected to the following tests in the order indicated:
- a. Elongation and contraction - 4.6.4
  - b. Impulse test (unaged samples only) - 4.6.9a through 4.6.9d less torsion
- 4.4.3.2 Material Tests, Inner Tube: Four hose assemblies (or one hose assembly from a lot of 5000 ft) in accordance with Table 3 shall be subjected to the following tests in the order indicated:
- a. Stress degradation test - 4.6.11
  - b. Conductivity test - 4.6.15
  - c. Specific gravity test (apparent and relative) - 4.6.2.4
- 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), and 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 Inspection Procedures: All inspection plans shall be single sample plans with an acceptance number of zero.
- 4.4.6 Destructive Test Sample: Prior to testing, a letter "D" shall be permanently marked 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, except samples 10 through 15 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 3.

4.5.2.2 Qualification test hose assemblies may be made up of one style connection on both ends, or a combination of two styles, each assembly including both styles. Both tested styles would then be qualified.

Qualification of fitting styles which are not subjected to the entire qualification test sequence shall be as follows:

Two additional assemblies shall be tested for each fitting style to be qualified. The additional assemblies shall be made up with one qualified fitting style and one fitting style which is to be qualified. These samples may have straight end fittings on both ends. The assemblies shall be subjected to the following tests in the sequence indicated:

- a. Examination of Product (4.6.1) - Sample No. 1, 2
- b. Proof pressure test (4.6.3) - Sample No. 1, 2
- c. Leakage test (4.6.6) - Sample No. 1, 2
- d. Repetitive assembly torque test (4.6.12) - Sample No. 1, 2
- e. Room temperature burst pressure test (4.6.7) - Sample No. 1, 2
- f. Torsion-impulse test (4.6.9) (unaged samples) - Sample No. 1, 2

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 aged for 7 days in an air oven at a temperature of 400 °F. 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 for 7 days in air at a temperature of 400 °F.

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. Where a high temperature test fluid is specified, the test fluid shall be MIL-PRF-7808 or MIL-PRF-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 6 in of 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 CRES male fitting end in accordance with AS4395, AS4658, AS4375, or MIL-F-85421/1 lubricated with either MIL-H-5606 fluid or the test fluid, with the installation torque range specified in ARP908. Beam seal fittings shall be torqued per MIL-F-85421.
- 4.5.6 Pressure Measurements: Unless otherwise specified, all pressures shall have a tolerance of  $\pm 100$  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 document 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 document with respect to material, size, and workmanship.
- 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 AS2078. The flattening gap, rounding gap, and proof pressure values shall be as specified for 3000 psi and higher. The test media shall be air or water.
- 4.6.2.2 Tensile Strength: The tube shall be subjected to the tensile strength test in accordance with AS2078.
- 4.6.2.3 Elongation: The tube shall be subjected to the elongation in accordance with AS2078.
- 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 AS2078. When test samples are prepared from braided hose, the braid impression must be removed prior to testing.
- 4.6.2.4.2 Relative Specific Gravity: Relative specific gravity shall be determined in accordance with AS2078.
- 4.6.3 Proof Pressure Test: All hose assemblies shall be pressure tested to the values specified in Table 2 in accordance with AS2078.
- 4.6.4 Elongation and Contraction Test: Two hose assemblies of each size shall be subjected to the elongation and contraction test in accordance with AS2078.
- 4.6.5 Volumetric Expansion Test: Two hose assemblies of each size shall be subjected to the volumetric expansion test in accordance with AS2078.