SAE INTERNATIONAL

AEROSPACE STANDARD

AS604™ REV. F

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Superseding AS604E

Hose Assembly, Polytetrafluoroethylene, Metallic Reinforced, 3000 psi, 400 °F, Heavyweight, Hydraulic

RATIONALE

Added part standards listings (removed reference to AS604SUP1); removed straight fitting ball requirements in Table 1.

1. SCOPE

This SAE Aerospace Standard (AS) defines the requirements for a heavy braid polytetrafluoroethylene (PTFE) lined, metallic reinforced, hose assembly suitable for use in high temperature, 400 °F, high pressure, 3000 psi, aircraft hydraulic fluid systems, also for use in pneumatic systems which allow some gaseous diffusion through the PTFE wall. The -20 size operating temperature is limited to 275 °F maximum.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document 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 document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AC7112	NADCAP Audit Criteria for Fluid Systems Component Manufacturers
AMS2700	Passivation of Corrosion Resistant Steels
AMS5556	Steel, Corrosion and Heat-Resistant, Seamless or Welded Hydraulic Tubing 18Cr - 11Ni - 0.70Cb (SAE 30347) Solution Heat Treated
AMS5557	Steel, Corrosion and Heat-Resistant, Seamless or Welded Hydraulic Tubing, 18.5Cr - 10.5Ni - 0.40Ti (SAE 30321), Solution Heat Treated

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AS604F/

AMS5561 Steel, Corrosion and Heat-Resistant, Welded and Drawn or Seamless and Drawn Tubing, 9.0Mn - 20Cr - 6.5Ni - 0.28N, High-Pressure Hydraulic

AMS5567 Steel, Corrosion Resistant, Seamless or Welded Hydraulic Tubing 19Cr - 10Ni (304) Solution Heat Treated

AMS5570 Steel, Corrosion and Heat-Resistant, Seamless Tubing 18Cr - 11Ni - 0.40Ti (321), Solution Heat Treated

AMS5571 Steel, Corrosion and Heat-Resistant, Seamless Tubing, 18Cr - 10.5Ni - 0.70Cb (Nb) (347), Solution Heat Treated

AMS5573 Steel, Corrosion and Heat-Resistant, Seamless Tubing, 17Cr - 12Ni - 2.5Mo (SAE 30316), Solution Heat Treated

AMS5575 Steel, Corrosion and Heat-Resistant, Welded Tubing, 18Cr - 10.5Ni - 0.70Cb (Nb) (347), Solution Heat Treated

AMS5581 Nickel Alloy, Corrosion and Heat-Resistant, Seamless or Welded Tubing, 62Ni - 21.5Cr - 9.0Mo - 3.7Cb (Nb), Annealed

AMS5639 Steel, Corrosion-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 19Cr - 10Ni, Solution Heat Treated

AMS5643 Steel, Corrosion-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 16Cr - 4.0Ni - 0.30Cb - 4.0Cu, Solution Heat Treated, Precipitation Hardenable

AMS5644 Steel Bars and Forgings, Corrosion Heat Resistant, 17Cr - 7Ni - 1Al

AMS5645 Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings, 18Cr - 10Ni - 0.40Ti (321), Solution Heat Treated

AMS5646 Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 18Cr - 11Ni - 0.60Cb(Nb) (347), Solution Heat Treated

AMS5647 Steel, Corrosion-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 19Cr - 9.5Ni, Solution Heat Treated

AMS5648 Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 17Cr - 12Ni - 2.5Mo (316) Solution Heat Treated

AMS5653 Steel, Corrosion and Heat-Resistant, Bars, Wire, Forgings, Tubing, and Rings, 17Cr - 12Ni - 2.5Mo (0.030 Max C) (316L), Solution Heat Treated

AMS5659 Steel, Corrosion-Resistant, Bars, Wire, Forgings, Rings, and Extrusions 15Cr - 4.5Ni - 0.30Cb (Nb) - 3.5Cu

AMS5666 Nickel Alloy, Corrosion and Heat-Resistant, Bars, Forgings, Extrusions, and Rings, 62Ni - 21.5Cr - 9.0Mo - 3.65 Cb (Nb), Annealed

AMS5688 Steel, Corrosion-Resistant, Wire, 18Cr - 9.0Ni (SAE 30302), Spring Temper

AMS5689 Steel, Corrosion and Heat Resistant, Wire, 18Cr - 10.5Ni - 0.40Ti (SAE 30321), Solution Heat Treated

AMS5690 Steel, Corrosion and Heat Resistant, Wire, 17Cr - 12Ni - 2.5Mo (316) Solution Heat Treated

AMS5697 Steel, Corrosion-Resistant, Wire, 19Cr - 9.5Ni (SAE 30304), Solution Heat Treated

AMS5743	Steel, Corrosion and Heat-Resistant, Bars and Forgings 15.5Cr - 4.5Ni - 2.9Mo - 0.10N Solution Heat Treated, Sub-Zero Cooled, Equalized, and Over-Tempered
AMS-QQ-S-763	Steel, Corrosion Resistant, Bars, Wire, Shapes, and Forgings
ARP908	Torque Requirements, Installation and Qualification Test, Hose and Tube Fitting
ARP1835	Preparation for Delivery General Requirements for Hose Assemblies
AS150	Hose Assembly, Type Classifications of, Basic Performance and Fire Resistance
AS611	Hose Assembly and Tubing, Polytetrafluoroethylene, Cleaning Methods For
AS1055	Fire Testing of Flexible Hose, Tube Assemblies, Coils, Fittings, and Similar System Components
AS1072	Sleeve, Hose Assembly, Fire Protection
AS2078	Test Methods, Hose Assemblies, Polytetrafluoroethylene (PTFE)
AS4375	Fitting End, Flareless, Design Standard
AS4395	Fitting End, Flared, Tube Connection, Design Standard
AS7003	Nadcap Program Requirements
AS8879	Screw Threads - UNJ Profile, Inch Controlled Radius Root with Increased Minor Diameter
AS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
AS85421	Fittings, Tube, Fluid Systems, Separable, Beam Seal, 3000/4000 psi, General Specification For
AS85421/1	Fitting End, Standard Dimensions for Dynamic Beam Seal, Male

2.1.2 ASME Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 973-882-1170 (outside North America), www.asme.org.

ASME B46.1	Surface Texture
ASME Y14.24	Types and Applications of Engineering Drawings
ASME Y14.34M	Parts Lists, Data Lists, and Index Lists: Associated Lists
ASME Y14.35M	Revision of Engineering Drawings and Associated Documents
ASME Y14.100	Engineering Drawing Practices

2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM A262 Standard Recommended Practices for Detecting Susceptibility to Intergranular Attack in Stainless Steel

ASTM A313 Standard Specification for Stainless Steel Spring Wire

ASTM A580 Specification for Stainless and Heat Resisting Steel Wire

2.1.4 NAS Standards

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NAS 847 Caps and Plugs, Protective, Dust and Moisture Seal

NAS 1760 Fitting End, Flareless Acorn, Standard Dimensions for

2.1.5 PRI Publications

Available from Performance Review Institute, 161 Thorn Hill Road, Warrendale, PA 15086-7527, Tel: 724-772-1616, www.pri-network.org.

PD2001 Qualified Product Management Council Procedures for Qualified Products Group

PD2101 Aerospace Quality Assurance, Product Standard, Qualification Procedures, Fluid Systems

2.1.6 U.S. Government Publications

Copies of these documents are available online at https://quicksearch.dla.mil.

MIL-H-5606 Hydraulic Fluid, Petroleum Based; Aircraft; Missile and Ordnance

MIL-HDBK-831 Preparation of Test Reports

MIL-PRF-680 Degreasing Solvent

MIL-PRF-7808 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

MIL-PRF-83282 Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft

MIL-PRF-87257 Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile

MIL-STD-130 Identification Marking of U.S. Military Property

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 Hose Assembly SAE Publications

Available from Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org. The hose assembly standards applicable to this procurement standard include:

AS621 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flareless, Straight to Straight, Heavyweight

AS622 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flareless, Straight to 45°, Heavyweight

AS623 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flareless, Straight to 90°, Heavyweight

AS624 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flareless, 45° to 45°, Heavyweight

AS625 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flareless, 45° to 90°, Heavyweight

AS626 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flareless, 90° to 90°, Heavyweight

AS627 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flared, Straight to Straight, Heavyweight

AS628 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flared, Straight to 45°, Heavyweight

AS629 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flared, Straight to 90°, Heavyweight

AS630 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flared, 45° to 45°, Heavyweight

AS631 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flared, 45° to 90°, Heavyweight

AS632 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Flared, 90° to 90°, Heavyweight

AS4352 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Beam Seal, Straight to Straight, Heavyweight

AS4353 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Beam Seal, Straight to 45°, Heavyweight

AS4354 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Beam Seal, Straight to 90°, Heavyweight

AS4355 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Beam Seal, 45° to 45°, Heavyweight

AS4356 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Beam Seal, 45° to 90°, Heavyweight

AS4357 Hose Assembly, Polytetrafluoroethylene, Cres Reinforced, 400 °F, 3000 psi, Beam Seal, 90° to 90°, Heavyweight

3. TECHNICAL REQUIREMENTS

3.1 Qualification

Hose assemblies supplied in accordance with this document shall be representative of products which have been subjected to and which have successfully passed the qualification tests in this standard.

3.1.1 Manufacturer Qualification

A manufacturer producing a product in conformance to this procurement specification shall be accredited in accordance with the requirements of OP2007 Appendix G3, AS7003, and AC7112, and shall be listed in a Performance Review Institute (PRI) Qualified Manufacturers List (QML).

3.1.2 Product Qualification

All products shall conform to the requirements of this procurement specification and shall be approved in accordance with the requirements of PD2000 and OP2007 Appendix G3 for listing in a Performance Review Institute (PRI) Qualified Products List (QPL).

3.2 Material

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

a. Bars and Forgings

(1) AMS-QQ-S-763 Class 304 - Cond. A or B (AMS5639)

(2) AMS-QQ-S-763 Class 304L - Cond. A (AMS5647)

(3) AMS-QQ-S-763 Class 316 - Cond. A (AMS5648)

(4) AMS-QQ-S-763 Class 316L - Cond. A (AMS5653)

(5) AMS-QQ-S-763 Class 321 - Cond. A (AMS5645)

(6) AMS-QQ-S-763 Class 347 - Cond. A (AMS5646)

(7) AMS5643 17-4PH

(8) AMS5644 17-7PH

(9) AMS5659 15-5PH

(10) AMS5743 AM-355

(11) AMS5666 Nickel Alloy Type 625

b. Tubing

(1) AMS5567 Type 1 or Type 2 Stainless Steel Tubing, 304

(2) AMS5573 Seamless Stainless Steel Tubing, 316

(3) AMS5557 Type 1 or Type 2 Stainless Steel Tubing, 321

(4) AMS5570 Seamless Stainless Steel Tubing, 321

(5) AMS5571 Seamless Stainless Steel Tubing, 347

(6) AMS5575 Welded Stainless Steel Tubing, 347

(7) AMS5556 Type 1 or Type 2 Stainless Steel Tubing, 347

(8) AMS5561 Welded Stainless Steel Tubing, 21-6-9

(9) AMS5581 Type 1 or Type 2 Nickel Alloy Tubing, 625

c. Wire

(1) ASTM A580/A313 Comp. 302 (AMS5688)

(2) ASTM A580/A313 Comp. 304 (AMS5697)

(3) ASTM A580/A313 Comp. 316 (AMS5690)

(4) ASTM A580/A313 Comp. 321 (AMS5689)

3.3 Design and Construction

The hose assembly shall consist of a seamless PTFE inner tube, corrosion-resistant steel-wire reinforcement, and corrosion-resistant steel or nickel alloy 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 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 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 permanently attached and proven to meet the requirements herein. Standard hose assemblies shall have flared fittings to mate with AS4395; flareless fittings according to NAS 1760 to mate with AS33514 or AS4375; or beam seal fittings per AS85421. Fitting hex portions shall fit standard wrench openings.

3.3.3.1 Straight Fittings

Straight fittings shall be of one piece construction. Weld or braze joints must not be located in the fluid paths, except welded and redrawn corrosion-resistant steel tubing in accordance with 3.2.1 may be used.

3.3.3.2 Other Fittings

Other fittings, including elbow fittings, 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 corrosion-resistant steel tubing in accordance with 3.2.1 and shall employ a butt weld joint method.

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 A262 Practice E, prior to assembly to the nipple or swaging operation. Sockets fabricated from stabilized austenitic steel (304L, 321, or 347) are acceptable without being subjected to the embrittlement test.

3.3.3.4 Fitting Finish

3.3.3.4.1 Corrosion Resistant Steel Parts

Unless otherwise specified, corrosion resistant steel parts shall be passivated in accordance with AMS2700.

3.4 Dimensions

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

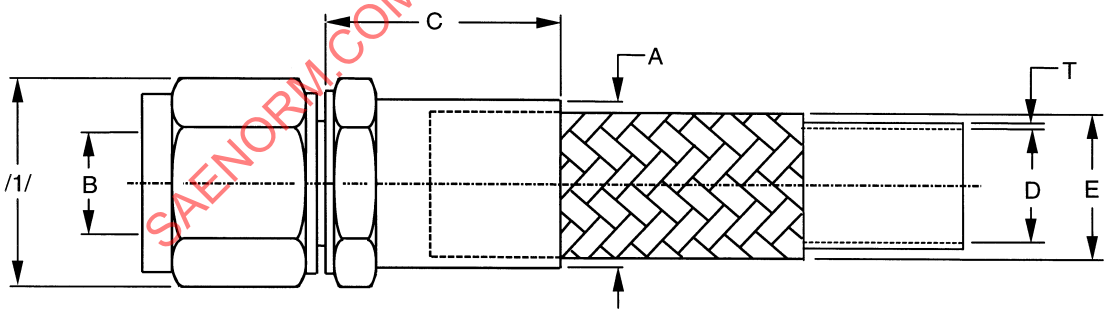

Figure 1 - Hose and fitting dimensions

Table 1 - Hose and fitting dimensions as shown in Figure 1 (inches)

Hose Size	Rigid Tube OD (Ref)	Fitting OD A Max	Fitting ID B[2] Min	Socket Length C Max	Hose ID D Min	Hose OD E Min	Hose OD E Max	Unbraided Inner Tube Wall T Min	Spherical Ball Size for Determining Min Hose Assy. ID[2] in Fittings
04	0.250	0.875	0.135	2.25	0.212	0.405	0.465	0.035	0.115
06	0.375	1.000	0.240	2.50	0.298	0.535	0.595	0.035	0.204
08	0.500	1.200	0.340	2.75	0.391	0.675	0.735	0.045	0.289
10	0.625	1.406	0.410	3.00	0.485	0.875	0.935	0.045	0.349
12	0.750	1.687	0.510	3.25	0.602	1.030	1.090	0.045	0.434
16	1.000	2.000	0.760	3.75	0.852	1.350	1.410	0.050	0.646
20	1.250	2.100	0.925	3.88	1.101	1.560	1.650	0.050	0.786

[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.

3.4.1 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.

Table 2 - Physical requirements of hose assemblies and weight of hose

Hose Size	(Nominal Tube Size)	Hose Weight Max[1] lb/in	Operating Pressure psi	Proof Pressure psi	Burst Pressure Room Temperature Minimum psi	Burst Pressure High Temperature Minimum psi	Bend Radius at Inside of Bend Minimum Inches	Volumetric Expansion Maximum cm^3/in
04	0.250	0.012	3000	6000	16 000	12 000	3.00	0.065
06	0.375	0.028	3000	6000	14 000	10 500	5.00	0.085
08	0.500	0.040	3000	6000	14 000	10 500	5.75	0.135
10	0.625	0.062	3000	6000	12 000	9000	6.50	0.220
12	0.750	0.086	3000	6000	12 000	9000	7.75	0.300
16	1.000	0.140	3000	6000	12 000	9000	9.63	0.750
20	1.250	0.180	3000	6000	12 000	9000	12.00	1.000

[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 Inner Tube

3.5.1.1 Tube Roll

The tube shall not leak, split, burst, or show any evidence of malfunction when rolled to the flattening and rounding gaps of AS2078 (3000 psi and higher) values. The test method is 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 minute. 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. The transverse tensile strength for sizes -10 and larger shall be 1800 psi minimum. For sizes -08 and smaller the transverse tensile strength need not be tested. The test method is specified in 4.6.2.2.

3.5.1.4 Elongation

Elongation shall be a minimum of 200%. The test method is specified in 4.6.2.3.

3.5.1.5 Specific Gravity

The specific gravity values of the hose inner tube shall not exceed 2.155 apparent and 2.210 relative. The test method is 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. The test method is specified in 4.6.3.

3.5.2.2 Elongation and Contraction

The hose assembly shall not change in length by more than ±2% in 10 inches of hose length when subjected to the operating pressure in Table 2 for a minimum of 5 minutes. The test method is specified in 4.6.4.

3.5.2.3 Volumetric Expansion

The volumetric expansion of the hose assemblies shall not exceed the limits specified in Table 2. The test method is specified in 4.6.5.

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. The test method is specified in 4.6.6.

3.5.2.5 Thermal Shock

The hose assemblies shall not leak nor show any evidence of malfunction when subjected to the Table 2 proof and high temperature burst pressure, after being thermally shocked by rapidly increasing hose temperature from -65 to 400 °F for sizes -16 and smaller, and -65 to 275 °F for size -20. The test method is specified in 4.6.7.

3.5.2.6 Impulse

The hose assemblies shall show no evidence of leakage from hose or fitting prior to completion of 250000 pressure impulse cycles. The test method is specified in 4.6.8.

3.5.2.7 Assembly Flexibility

The hose assembly shall not leak nor show any evidence of malfunction when subjected to the Table 2 proof pressure after 400000 flexure cycles. The test method is specified in 4.6.9.

3.5.2.8 Stress Degradation (Air Leakage)

The air leakage rate from the hose and two end fittings (not including “B” nuts) when held at the Table 2 operating pressure after completion of the stress degradation test shall not exceed 2.0 cm^3/in/min. The test method is specified in 4.6.10.

3.5.2.9 Pneumatic Surge

There shall be no evidence of inner tube collapse, sponging or shedding of PTFE particles from the inner tube after 16 cycles of rapid reduction of pneumatic pressure from the Table 2 operating pressure to 0 psi. The test method is specified in 4.6.11.

3.5.2.10 Pneumatic Effusion

The effusion rate for any hose size shall not exceed 8.0 cm^3/ft of hose length. The test method is specified in 4.6.12.

3.5.2.11 Repetitive Assembly Torque

The flared and flareless fittings shall withstand the repetitive assembly torque values specified in ARP908, and beam seal fittings per AS85421, without failure or leakage. There shall be no leakage, galling, or other malfunction of the fitting nut and interface connection during the specified pressure test. The test method is specified in 4.6.13.

3.5.2.12 Room Temperature Burst Test

The hose assembly shall not leak nor burst at any pressure below the room temperature burst value specified in Table 2. The test method is specified in 4.6.14.

3.5.2.13 Electrical Conductivity

Hose assembly sizes -08 and smaller shall conduct a direct current equal to or greater than 6 µA and sizes -10 and above a direct current equal to or greater than 12 µA with a test potential of 1000 VDC. The test method is specified in 4.6.15.

3.5.2.14 Resistance to Fire

When the hose assembly is required to withstand a specified resistance to fire, the hose assembly may be fitted with an integral silicone or AS1072 tubular, or equivalent, fire sleeve and shall withstand the effects of the flame without leakage. The test method is specified in 4.6.16.

3.6 Screw Threads

Coupling nut threads shall be in accordance with AS8879 (ISO 3161). 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. ±0.125 inch for lengths under 18 inches

b. ±0.250 inch for lengths from 18 to 36 inches, exclusive

c. ±0.500 inch for lengths from 36 to 50 inches, exclusive

d. ±1% for lengths of 50 inches and over

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 ASME Y14.100, ASME Y14.24, ASME Y14.35M, and ASME Y14.34M 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 shall be applied on a fitting or on a permanent band, or bands, securely attached on the hose. The band shall be no wider than 1 inch and shall not impair the flexibility or the performance of the hose. Unless otherwise specified, the marking on the fitting or band shall include the following information:

a. Assembly manufacturer's name or trademark and assembly specification AS604

b. CAGE code and complete hose assembly part number

c. Operating pressure “3000 psi”

d. Operating temperature “400 °F”, as applicable (275 °F for size -20)

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 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 microinches Ra maximum per ASME B46.1 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

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.

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 Inspections

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

a. Qualification inspections (see 4.3)

b. Quality conformance inspections (see 4.4)

4.3 Qualification Inspections

4.3.1 Qualification Test Samples

The number and length of test samples required to qualify each hose size are specified in Table 3. All specimens for each hose size are required for qualifying each of the methods of end fitting attachment and for each method of end fitting construction, bent tube or forged. Simultaneous qualification of different types of end fittings may be accomplished by having fittings of one type on one hose end and fittings of another type on the other end. If a supplier qualifies one end fitting outlet design and at a later date desires to qualify the other, two hose assemblies of each size to be qualified shall be subjected to the tests specified in 4.5.1.1.

Table 3 - Length of hose assemblies for test (inches)

Hose Assy Size	Six Assemblies for Impulse Test (4.6.8)	Two Assemblies for Flex Test (4.6.9)	Six Assemblies for Other Tests[1]
04	16	20	18
06	21	27	18
08	24	30	18
10	30	33	18
12	33 (20[2])	37	18
16	41 25[2])	45	18
20	52 (32[2])	56	18

[1] One additional sample of each size in lengths as shown in Figure 4 shall be used for examination and electrical conductivity tests.
[2] Reduced assembly length if testing is performed at a 90 degree bend.

4.3.2 Qualification Test Sequence

Test sequence and procedure shall be as specified in Table 4 and, if applicable, 4.5.1.1.

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-HDBK-831 which shall include a report of all tests and outline description of the tests and conditions.

b. Test Samples: Test samples when requested by the procuring activity. Samples subjected to qualification testing shall not be shipped as part of contract or order.

c. Drawings: Three sets of assembly and subassembly drawings. The assembly drawings shall have a cut-away section showing all details in their normal assembly position and shall define all details and 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.

Table 4A - Qualification test sequence and number of samples[1]
(Inner tube and hose assemblies 1-8)

	Inner Tube	Inner Tube	Hose Assembly 1	Hose Assembly 2	Hose Assembly 3	Hose Assembly 4	Hose Assembly 5	Hose Assembly 6	Hose Assembly 7	Hose Assembly 8
4.6.1.1 Examination of Product[2]	0	0								
4.6.2.1 Proof Pressure[2]	0	0								
4.6.2.1 Tube Roll[2]	0	0								
4.6.2.2 Tensile Strength[2]	0	0								
4.6.2.3 Elongation[2]	0	0								
4.6.2.4 Specific Gravity[2]	0	0								
4.6.1.2 Examination of Product			0	0	0	0	0	0	0	0
4.6.3 Proof Pressure			0	0	0	0	0	0	0	0
4.6.4 Elongation and Contraction			0	0						
4.6.5 Volumetric Expansion					0	0				
4.6.6 Leakage							0	0		
4.6.7 Thermal Shock							0	0		
4.6.8 Impulse: Unaged										
Air Aged										
Oil Aged										
4.6.9 Assembly Flexibility			0	0						
4.6.10 Stress Degradation									0	0
4.6.11 Pneumatic Surge									0	0
4.6.12 Pneumatic Effusion					0	0				
4.6.13 Repetitive Assy Torque			0	0						
4.6.14 Room Temp Burst Pressure					0	0				
4.6.15 Electrical Conductivity										
4.6.16 Fire Resistance (when required)										

[1] One circle "0" means one inspection.
[2] Production lot records may be used to verify conformance to these tests when the PTFE tube or hose assembly being used is an established production item.

Table 4B - Qualification test sequence and number of samples[1]
(Hose assemblies 9-18)

	Hose Assembly 9	Hose Assembly 10	Hose Assembly 11	Hose Assembly 12	Hose Assembly 13	Hose Assembly 14	Hose Assembly 15	Hose Assembly 16	Hose Assembly 17	Hose Assembly 18
4.6.1.1 Examination of Product[2]										
4.6.2.1 Proof Pressure[2]										
4.6.2.1 Tube Roll[2]										
4.6.2.2 Tensile Strength[2]										
4.6.2.3 Elongation[2]										
4.6.2.4 Specific Gravity[2]										
4.6.1.2 Examination of Product	0	0	0	0	0	0	0	0	0	0
4.6.3 Proof Pressure	0	0	0	0	0	0		0	0	0
4.6.4 Elongation and Contraction										
4.6.5 Volumetric Expansion										
4.6.6 Leakage										
4.6.7 Thermal Shock										
4.6.8 Impulse: Unaged	0	0								
Air Aged			0	0						
Oil Aged					0	0				
4.6.9 Assembly Flexibility										
4.6.10 Stress Degradation										
4.6.11 Pneumatic Surge										
4.6.12 Pneumatic Effusion										
4.6.13 Repetitive Assy Torque										
4.6.14 Room Temp Burst Pressure										
4.6.15 Electrical Conductivity							0			
4.6.16 Fire Resistance (when required)								0	0	0

[1] One circle “0” means one inspection.
[2] Production lot records may be used to verify conformance to these tests when the PTFE tube or hose assembly being used is an established production item.

4.3.4 Qualification Inspection Methods

Qualification inspection methods 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 (see 4.4.1) (100% inspection)

b. Sampling tests (see 4.4.2)

c. Periodic control tests (see 4.4.3)

4.4.1 Individual Tests

Each hose assembly shall be subjected to the following tests:

a. Examination of product (see 4.6.1)

b. Proof pressure test (see 4.6.3)

NOTE: Production samples that are proof pressure tested with water should be air dried prior to capping (see 3.10.2).

4.4.2 Sampling Tests

The following inspections and tests shall be performed in the order indicated on eight hose assemblies with straight fittings at each end selected at random from each inspection lot. The inspection lot shall consist of approximately, but not more than, 3000 hose assemblies, all of one dash size manufactured under essentially the same conditions, but not necessarily during one continuous run. One hose assembly tested from each lot of 375 hose assemblies is also permitted.

a. Internal cleanliness (AS611, Class 0)

b. Leakage tests (see 4.6.6)

c. Room temperature burst pressure test (see 4.6.14)

4.4.3 Periodic Control Tests

4.4.3.1 Hose Assemblies

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 20000 feet of hose, all of one dash number size, manufactured under essentially the same conditions but not necessarily during one continuous run. Two hose assemblies manufactured and tested from each lot of 5000 feet of hose is also permitted.

4.4.3.1.1 Assembly

Four hose assemblies or one hose assembly from a lot of 5000 feet in accordance with Table 3 shall be subjected to the following tests in the order indicated:

a. Elongation and contraction test (see 4.6.4)

b. Impulse test (see 4.6.8) (unaged samples only and may have straight fittings on both ends)

4.4.3.1.2 Assembly and Inner Tube

Four hose assemblies or one hose assembly from a lot of 5000 feet in accordance with Table 3 shall be subjected to the following tests in the order indicated:

a. Stress degradation test (see 4.6.10)

b. Electrical conductivity test (see 4.6.15)

4.4.3.2 Fire Resistant Hose Assemblies

The following test shall be performed, as defined below, on one hose assembly of each QPL listed fire sleeve configuration type, integral silicone and AS1072 tubular sleeve, produced within the PRI defined reporting year. The test sample shall be built by production personnel using the same processes as used for product approval to the QPL.

a. Test Sample Size: Fire testing shall be performed on the smallest hose size for each of the QPL listed fire sleeve type produced during the reporting year.

b. Fire Test: Fire testing shall be performed to the requirements of AS1055.

c. Flow Condition: Fire testing shall be performed at the lowest flow (most critical) condition, 1 x ID^2 or 5 x ID^2, for each QPL approved product.

d. Test Duration: Fire testing shall be performed at the longest (most critical) test duration; fireproof (15 minutes) or fire resistant (5 minutes) for each QPL approved product.

4.4.3.2.1 Where an assembly fails to meet the 1xID^2 flow condition, an additional assembly may be tested for conformance to the lesser 5 x ID^2 condition. If the assembly passes the 5 x ID^2, product invoking the 5 x ID^2 are unaffected by the 1 x ID^2 failure.

4.4.3.2.2 Where an assembly fails to meet the 15 minute test duration, but exceeds 5 minutes, only assemblies imposing the 15 minute duration are affected.

4.4.3.2.3 Where the smallest QPL size fails the test, the next larger QPL qualified size may be tested. Should that test size pass the test, only the smallest size tested is affected.

4.4.4 Rejection and Retest

Where one or more items selected from a lot fails to meet the specifications, all items in the lot shall be rejected. In the event of a failed fire test, all assemblies manufactured from the suspect material (integral silicone or AS1072 tubular sleeve) under the applicable type designation 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 industry), 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 Procedure

All inspection plans shall be single sample plans with an accept 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 (see 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 for the impulse test samples requiring 90 degree elbow fitting at one end. Satisfactory completion of qualification tests shall also constitute qualification approval for hose assemblies having other fittings that have an identical attachment method and design and meet the requirements of this document.

4.5.1.1 Additional Fitting End Designs

If qualification approval is desired for other type end fitting, two additional hose assemblies with the type fittings and of the size to be qualified shall be subjected to the following tests in the sequence indicated:

a. Examination of product (see 4.6.1)

b. Proof pressure test (see 4.6.3)

c. Leakage test (see 4.6.6)

d. Repetitive assembly torque test (see 4.6.13)

e. Room temperature burst pressure test (see 4.6.14)

4.5.2 Preparation of Sample

4.5.2.1 Unless otherwise specified, length of sample assemblies shall be in accordance with Table 3.

4.5.2.2 Oil Aging

In all 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, except the maximum temperature for size -20 shall be 275 °F, for 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.

4.5.2.3 Air Aging

Air aged samples shall be kept in air at a temperature of 400 °F, except the maximum temperature for size -20 shall be 275 °F, for 7 days.

4.5.2.4 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, MIL-PRF-87257 or water. Where a high temperature test fluid is specified, the test fluid shall be MIL-PRF-83282 hydraulic fluid, MIL-PRF-7808 lubricating oil, or equivalent, unless otherwise specified by the user.

4.5.4 Pressure Measurements

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

4.5.5 Temperature Measurements

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

4.5.6 End Connections

Except as otherwise noted, each hose end shall be connected to a male fitting end in accordance with AS85421/1, AS4395, AS33514, or AS4375, lubricated with either MIL-PRF-87257 fluid or the test fluid and utilizing the installation torque range specified in AS85421 or ARP908, as applicable.

4.6 Inspection Methods

4.6.1 Examination of Product

4.6.1.1 Inner Tube (PTFE)

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 document with respect to material, size, and workmanship. Broken or missing reinforcing wires or any evidence of malfunction 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 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.